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ARCHITECTURE.

Plates 1—60.

I. ANCIENT ARCHITECTURE.

1. ANCIENT HINDOO ARCHITECTURE.

Hindoo Architecture, probably the most ancient that exhibits regular architectonical mouldings, is remarkable for its well defined character, for the distinct ground-plan of its temples, and for three different orders of pillars. As its leading features arose from the peculiarities of climate and situation, it has rarely been introduced into any other country.

Impressed with the idea that the worship of an eternal religion should be conducted in imperishable temples, and in order to insure their being both airy and cool, the Hindoos constructed and excavated these edifices in the rocks. The temples at Tintali, Dasavatara, and the grotto palace of Siva, near Ellora, number among the most ancient. They are all constructed in the following manner.

The entire temple being under ground, the ceilings are supported by pillars of three different sizes and forms, of various thicknesses, and more or less finished and elaborated. Some temples are so deep below the surface as to require two tiers of pillars, one above the other, as in the grotto temple of Indra Sabah at Ellora (*pl.* 2, *fig.* 2). All these pillars are entirely different from those in the Nubian or Egyptian temples. The temples receive no light except through the openings in front. The large pillars, or those of the first order, are square and plain, and from three to five and a half diameters in height. A few small fillets form a kind of base, and a fillet on the top constitutes a capital, upon which rests a sort of cornice, divided into three stripes, running from pillar to pillar. The higher pillars are of an octagonal form. Their base is composed of regular mouldings, and they have caps consisting of a fillet and torus, similar to the astragal of the Doric order, and probably its prototype, as it is supposed that the construction was introduced into the island of Crete from India, where the Indian cap was rounded to suit the round column. Similar pillars are found in the interior of the temple of Wisua Karmah (*fig.* 4), and as supporters of the ceiling of the Kailasa, as well as in the grotto temple of Indra Sabah, near Ellora. This remarkable palace is 247 feet long, by 150 feet wide; and its height in the clear, divided by two tiers of pillars, is 47 feet. Some of the walls are

supported by elephants cut out of very hard stone. The exterior is ornamented with sculptures (*fig.* 2). The elephant near the pagoda-like building in the centre of the drawing, is called *Iravat*, and is dedicated to the Indian god of the heavens.

The pillars of the second order have a very high base (*pedestal*), and a square cap. Specimens of this order are met with in the upper tier of the grotto temple of Indra (*fig.* 2); of Vishnu Karmah (*fig.* 4); and Rabana (*pl.* 3, *fig.* 15).

The pillars of the third order have a base composed of regular mouldings and a round cap formed of a double torus, divided by a fillet. Above the cap is an echinus, similar to the Doric cap; and above that, a small slab which supports the cornice. In some instances the base has no mouldings (*pl.* 1, *figs.* 6, 7). The columns in front of the Indra temple (*pl.* 2, *fig.* 2), the grotto temple on the island of Elephanta (*pl.* 1, *fig.* 7; *pl.* 2, *fig.* 3), the interior of the temple of Indra (*fig.* 5), and the grotto temple at Parashua Rama (*pl.* 3, *fig.* 14), present the best specimens of these pillars.

According to the different forms of pillars, Hindoo Architecture, in general, is divided into several periods, characterized in the following manner: 1st, The plain style. 2d, The decorative style. 3d, The elegant style. 4th, The meretricious style. The buildings of Tintali and Dasavatara, near Ellora, and the pyramidal temple (*Pagoda*) Visvisor, near Benares (*pl.* 1, *fig.* 4), a buddhistic building, belong to the first period. For the mythological history of these buildings the reader is referred to the division Mythology of this work.

The grotto temple of Siva and the temple of Wisua Karmah (the heavenly architect), both at Ellora, are specimens of the style of the second period.

The Indra temple at Ellora, and the grotto temple on the island Elephanta, belong to the third period.

Temples, the outer walls of which are decorated in an architectonical style, belong to the same period, as for instance the grotto temple of Kailasa, near Ellora. This temple (*pl.* 2, *fig.* 1) dedicated to the god Indra, is considered the finest architectural monument in Ellora. It is wrought out of a single piece of rock without any joints, and consists of three different portions: 1st, The entrance-hall with two wings. 2d, The chapel of Nundi. 3d, The main temple.

The entrance-hall, which begins at the termination of the exterior court-yard, is wrought in the form of a screen with two wings. It is located on the west side, at the lowest part of the hill, which varies from 47 feet to 104 feet in height. The excavation is 247 feet long, by 150 feet wide. The space outside the entrance is 88 feet long, by 138 feet wide. This hall is adorned with pilasters. The interior contains five different rooms, three of which are situated one behind the other, and form a passage to which two large rooms are attached, one on each side; all three rooms are decorated with sculptures. Staircases lead to the upper floor, which has windows on both sides. This floor, by means of a bridge cut in the rocks, communicates with the temple of Nundi (the bull of Siva), which forms a square of 16 feet on

each side. A door in the rear wall opens upon a second bridge 21 feet by 23, leading to the main temple, which is 90 feet high. The main temple entrance is formed by a portico with two porches leading to a peristyle, which communicates by staircases with the lower court-yard. The peristyle is 18 feet long, by 15 feet 2 inches wide, and 17 feet high. Four steps lead to the main temple hall, 61 feet long by 55 feet wide, and 17 feet 10 inches high. The ceiling of this hall is supported by 16 pillars. Two porches, one on each side of the hall, mark the approach to bridges forming a connexion with the main rock, in which the private rooms of the priests were built. Opposite the main entrance another portico leads to the sanctuary, which contains the statues of Indra and of Lingam; small doors on both sides of this portico open on a terrace surrounding the sanctuary, and communicating with five square chapels of different sizes, two of them projecting on the sides, and three in the rear of the temple. The height of the temple above the terrace is 50 feet. The court-yard which surrounds the temple contains a peristyle of pillars, in some places in two tiers. Near the bridge which leads from the entrance hall to the temple of Nundi are two colossal elephants, probably the *leaders* of those placed in the lower temple, apparently supporting it. Behind the elephants, ten feet from the smaller temple, stand two obelisks, 38 feet high, and 7 feet wide at the top, by 11 feet at the base; they are supposed to have supported lions.

Aurungzebe attempted to destroy these temples, by surrounding them with fire, and causing water to be poured on the glowing rocks; but the injury inflicted was only partial, and in some parts even the paintings on the walls have not been affected. Almost all temples of this description are cut out of a single rock. The most remarkable are at Mavalipuram, in the province of Mysore (*pl.* 1, *fig.* 1), called the seven pagodas, the smallest of which, decorated inside and outside with inscriptions illegible even to the Brahmins, is 24 feet high by 12 feet wide. To the second pagoda is attached a gallery formed by two tiers of columns. The columns in one tier rest upon bases composed of lions lying upon a double plinth, and the caps are formed by equestrian statues which support the architrave. These pagodas are estimated by the Bramins to be 4800 years old.

The fourth period is that of the *pagodas*, when no more rock-cut temples were constructed. The pagodas are overloaded with ornaments and grotesque sculptures, and are remarkable for their arrangement, as well as for the highly elaborated metallic work attached to them. The most important are found at Chalembaram in the kingdom of Tanjore, and at Madura or Tretshengur. Those in Tanjore form the entrance-portico to the large temple district of Chalembaram, dedicated to the god Vishnu.

Below the largest pagoda (*pl.* 1, *fig.* 2) is a colonnade of slender columns, in which is placed a statue of the bull Nundi, consecrated to Vishnu, cut out of a single block of stone (*monolith*). Another monolithic statue of the bull Nundi is found before a small tower-like temple near the pagoda of Madura or Tretshengur (*pl.* 1, *fig.* 3), which was cut in the quarry of Tanjore, about 60 miles distant; it is 16 feet long, and is estimated to weigh about

a hundred tons. The lower story of the pagodas is constructed of granite blocks, the upper story of burnt bricks. As a specimen of the elaborate sculptures of these buildings the trimmings of a window of the large pagoda are represented on *pl.* 3, *fig.* 13.

For the better understanding of the ancient Hindoo temple architecture we annex a general description of the temple district of Chalembaram.

A quadrangle of 1230 feet by 960 feet is surrounded by a double brick wall 30 feet high and 7 feet thick, faced with freestone slabs, which forms the *peribolus* or inclosure of the whole of the temple buildings. Each side has an entrance, a pagoda (*pl.* 1, *fig.* 3) constituting the *pylon* (gateway). The pylon or pagoda is constructed of stone for about 30 feet of its height, the remaining 120 feet being built of brickwork, anchored with copper clamps, and plastered with cement. The ornaments of the brickwork on the upper part are in better preservation than those cut in the stone.

The pagoda forms a passage to the court of the temples. On each side of this passage stands a column, resting upon a base moulded into the figure of a lion, the capitals of which are connected by a stone chain, cut out of the same piece with the columns, composed of 29 movable links, each 32 inches in circumference; and consequently, the block from which the two columns and the chain were cut, must have been about 60 feet long. There is a staircase in the pagoda leading to the top.

About one third of the court of the temples is portioned off by a wall into a quadrangular space, which contains three dark cells connected together, the stone ceilings of which are supported by pillars, all decorated with sculptures. The largest cell contains an image of Vishnu, to whom it is consecrated. In front of this smaller court is situated the pool of purification, where both sexes bathe.

The main temple, with a portico bordered on either side by three rows of columns, six in each row, which are covered by sculptures, and whose capitals are very similar to the ancient Ionic, which were probably borrowed from them, is located on the right hand side in the fore part of the court-yard, and surrounded by various colonnades. It is composed of the *pronaos* or ante-nave, the main nave, and the sanctuary, which contains a picture of the bull Nundi, and also a statue of Parvati, the consort of Vishnu. The situation of this statue gives rise to the supposition that this temple was consecrated to that goddess. On the left of the temple is a colonnade of 100 columns, covered with a stone ceiling, leading to a small dark building on the opposite side, designed for the use of the priests. At the left of the pool of purification stands the temple of eternity, surrounded by 1000 monolithic columns 30 feet high, with a ceiling partly of stone, partly of cemented bricks. This colonnade, one of the most remarkable constructions in existence, is 360 feet long by 210 feet wide, and offered to the three thousand priests, who passed here almost all their time, a cool and airy promenade at all hours of the day and night. The temple itself is small. It contains an ante-nave and a main nave, with a plain altar covered with gold leaf. The inscriptions upon the walls are unintelligible, even to the Brahmins.

There is much difference of opinion as to the age of the ancient Hindoo buildings. A careful examination of the different theories on the subject inclines us to place it at about 2500 years before Christ.

2. Egyptian Architecture.

Egypt, which, from the time of Sesostris, 1700 years B. C. to the Persian war, about 600 B. C., extended over Bactria, Æthiopia, Abyssinia, and Lybia, offers the most remarkable and important monuments for the study of the history of architecture, in her very numerous temples, palaces, pyramids, obelisks, and hypogea (under-ground buildings); and Herodotus, Diodorus Siculus, Pausanias, and Strabo certainly do her no more than justice in declaring that she surpasses all the nations of the earth in the magnificence and grandeur of her architectural monuments.

The style of architecture known as the Egyptian originated in the northern districts of Æthiopia and in Nubia, and was introduced to the lower districts of the river Nile by Egyptian colonists who migrated from Meroe under the command of some priests, and settled below the last cataract. The temple of Jupiter Ammon, between Thebes (the ancient metropolis) and Fezzan, the obelisks near Axum, and others, are evidences of the correctness of this statement. Pococke, Burkhardt, Beechey, Belzoni, and Gau are the best authorities on the history of Egyptian architecture.

The island of Philæ, about three miles from the city of Syene, above the last cataract of the Nile, which is here about 15,000 feet wide, is about 1156 feet long by 404 feet wide, and surrounded by a wharf built of square blocks. It contains the mausoleum of Osiris, a congeries of temples disposed according to the form of the island, which is shaped somewhat like the portion of a gun-stock from the butt-end to the place of insertion of the barrel, the smaller end pointing up the stream. At the southern extremity is situated a smaller temple, to which a large court-yard is attached, surrounded by porticoes leading to the two first *pylons* or *propylæa* (large temple entrances between tower-like buildings of considerable height) (*pl.* 6, *fig.* 9). These propylæa lead to the fore court of the temple of Osiris. On the west side of this court stands another temple, on the east the dwellings of the priests, and towards the north are the second propylæa (*fig.* 9, a perspective view of the fore court and the surrounding buildings). The second propylæon leads to a smaller yard, which, surrounded on three sides by porticoes, forms the fore hall of the temple of Osiris. *Pl.* 4, *fig.* 6 presents a perspective view of the hall, with the entrance to the large temple. The several parts of this series of temples differ considerably, not only in dimensions and proportions, but also in form and details.

The columns of the southern temple, the smallest monuments of Egyptian architecture, are not over 15 feet high, by 2 feet 3 inches in diameter. The capitals support cubes ornamented by four heads of Isis in relief, one on each side. The western temple is surrounded by a portico on all four sides.

The porticoes were covered, and had a pillar at each corner, with 19 columns between each of them. The Grecian porticoes being similarly arranged, were probably borrowed from these.

Near the southern temple commences a wall, in front of which runs a portico 228 feet long, formed by 32 columns richly ornamented with sculptures. On the opposite side of the fore court (the western) is a similar but shorter portico of 16 columns, which are 16 feet high, the proportion between the diameter and the height being as one to six. The capitals are ornamented with palm leaves, and the ceilings and the main cornice are covered with hieroglyphics. At the northern end of the fore yard are two lions in a recumbent position, cut out of red granite, and behind them stand two obelisks of the same material, decorated with hieroglyphics. These obelisks are immediately in front of the first propylæa, which are 118 feet long by 50 feet high. The hieroglyphics, composed of figures 21 feet high, are cut in a recess, so that the most prominent parts do not project beyond the surface of the propylæum. Besides the western temple, the most recent of them all, which was built 2500 years before Christ, there is in front of the priests' dwelling, on the eastern side of the second court-yard, a portico of 10 columns (*pl.* 6, *fig.* 9, and *pl.* 4, *fig.* 6) 23 feet 8 inches in height, and 13 feet in circumference. These columns, together with the ceiling and cornice, are decorated with hieroglyphics, and the capitals with designs derived from the foliation of plants. The portico is lighted by a skylight. The main temple of Osiris is divided into several compartments of about 19 feet in height. At the extremity of the temple is the sanctuary, with the statue and tomb of Osiris. The slabs in the ceiling are 15 to 16 feet long, by 3 to 4½ feet in thickness and width, and of about 17 tons weight each.

The very remarkable sculptures of this temple show that the Jewish lawgiver, who was conversant with the forms of the Egyptian religion, to a certain extent adopted its symbols in the Mosaic system. These hieroglyphics represent the cherubim, the ark of the covenant, the vessel in which Osiris came to Egypt, and the table with the sacred candlesticks and the showbread.

Besides the above-mentioned temples, the island of Philæ contains on the east side of the temple of Osiris the ruins of another temple, the columns of which measure 40 feet, or more than any other upon the island. The cubes between the capitals and the architraves are remarkable for their height, which is more than a diameter of the column, a proportion greater than in any other monument. Among the ruins of a smaller temple on the south side of the island columns are found not more than 11 feet in height. All the aforesaid temples are built of a kind of whitish sandstone, which is almost as durable as granite, although the rocks of the island itself are composed of red granite.

A portico of four columns and a few walls, all richly decorated with very elaborate sculptures, are the only marks of the spot once occupied by the city of Syene. The island of Elephantine contains the ruins of two temples, both of the same style of architecture. The one to the south is still in very good condition (*pl.* 4, *fig.* 1); it was consecrated to Kneph, the good spirit.

Pl. 5, *fig.* 1, represents the plan of the large temple of Apollinopolis Magna (Edfou) on the left bank of the Nile, between Syene and Esneh, which, before the French expedition, was almost unknown. This temple was consecrated to Horus or Arueris, the Egyptian Apollo. *Fig.* 2 shows the longitudinal section, *c k; fig.* 3, the elevation of the propylæa, *a a ; fig.* 4, a section through the fore court, with a view of the fore hall or pronaos; *fig.* 6, caps and cornice from the long portico, *e ; fig.* 6, the central part of the entablature in the elevation of the pronaos.

The entire edifice consists of: 1. An inclosure whose front side is formed by the propylæum, *a a* ,with the entrance, *c*, in front of which the two obelisks, *b*, *b*, are erected. 2. The peristyle or the first fore-court, *d*, with the porticoes, *e*, *e ;* the court has the appearance of a staircase of twelve steps, so as to make each succeeding column shorter than the other by the height of a step. 3. The pronaos, *f*, with six columns in the first row, and eighteen columns all together, all very beautiful; here commences the main wall of the temple, which is constructed with buttresses, and between it and the outer wall on each side are small side courts, *l l*. 4. The fore hall of the temple, *g*, with twelve columns, which through the passage way, *h*, communicates with the rooms of the priests, and with the staircases. 5. The sanctuary, *i*, behind which different other rooms are located.

The length of the temple is 484 feet, the front of the propylæa 212 feet, and the front of the main temple 145 feet. The circumference of the large columns is 20 feet, that of the capitals 37 feet. The length of the temple by itself is 300 feet, the width of the propylæa 150; their height is 75 feet, the depth 24. The width of the fore-court, *d*, in the clear is 75 feet, exactly equal to the width of the pronaos, *f*, and consequently all the proportions harmonize. The length of the temple is eight times the height of the pronaos, four times the height of the propylæa, and twice their width. All the different apartments are lighted by skylights. The two stories of the propylæa are furnished with inner staircases, and are lighted by openings in the wall and in the ceiling. Grooves are cut in the front walls of the propylæa to receive the triumphal flagstaffs.

All the walls, outer as well as inner, all the columns and entablatures, and almost all the ceilings, are covered with highly elaborate symbolic sculptures and hieroglyphics, which are still in very good condition. Some of the capitals in the form of vases, decorated with palm leaves and date branches, are of uncommon beauty, and are symmetrically arranged. From the striking resemblance of the leaves and volutes to the Corinthian capitals, we might not unreasonably suppose the latter to have been modelled after them.

Near this large temple is located a smaller one consecrated to Typhon, the evil spirit, not more than 74 feet long, 45 feet wide, and 23½ high. One of the ornamental sculptures shows that at the time when the temple was building the summer solstice was in the sign of Leo; the temple, therefore, must have been erected about 2500 years before Christ.

On the island of Masuniah, about six miles below Apollinopolis, are situated the famous rock-cut tombs of Silsilis (*pl.* 4, *fig.* 7), constructed on the same principle as the Persian tombs. They form very deep grottoes, to which architectural fronts are attached. In these grottoes are found two

large inscriptions cut in the rock, and set in a frame of hieroglyphics, representing the different labors of agriculture, fishing, hunting, the vintage, and cattle breeding, and therefore of some interest for the study of Egyptian manners and habits (See History: Plates, Division IV, *pl.* 1, *figs.* 2–10). One of the grottoes is 24 feet long by 12½ feet wide, with an arched ceiling.

There is another group of temples at Latopolis (Esneh). *Pl.* 4, *fig.* 5 *b*, shows half the elevation of the pronaos of that temple which is in the best preservation. The pronaos is a hall with 24 columns; those in the first row, up to about half their height, are connected by walls. A somewhat narrower temple situated behind this hall, is surrounded by a colonnade of 29 columns, with massive pillars in the corners. The lintels are 21 to 25 feet long by 6 feet wide. All the walls, the ceilings, and the columns are decorated with sculptures relating chiefly to Osiris. A little more to the north is another temple, but in a rather bad condition. According to the representation of the zodiac on the ruins, the temples at Latopolis must have been erected 2600 years before Christ.

Opposite Latopolis, at Contralatopolis, is a temple, the columns of which are 19 feet high by three feet in diameter. Near Hermonthis (Ermeut) are the ruins of a temple which was erected about 2000 years before Christ, of materials previously used in another temple, a fact proved by the appearance of the ashlars, which contain fragments of hieroglyphic inscriptions, having been cut down from larger blocks of stone.

The city of Thebes, the ancient Diospolis Magna, was situated upon both banks of the Nile, and surrounded by a wall 60 feet thick, furnished with 100 gates. Here are found a large number of edifices important for the study of architecture. In giving a description of the most celebrated of them, we first notice the ruins of a very large racecourse (hippodromus) which extended 75,000 feet in length by 3000 feet in width, and was surrounded by a brick wall. It covered about 6,250,000 square fathoms, and therefore was about seven times as large as the Champ de Mars at Paris. There was a second racecourse of 5232 feet by 3234 on the opposite bank, the right bank of the Nile. The ruins of the palace of Sesostris, and of several temples and other buildings, are situated on the left bank of the river.

In the palace of Sesostris, erected about 1700 years before Christ, are three large courts, two of them surrounded by colonnades. The first propylæum is 192 feet long, 27 feet deep, and 66 feet high, and contains several rooms. Its vast entrance leads to an extensive court, bounded on two sides by galleries, and on the others by the first and second propylæa. The northern gallery, which is roofed over, is composed of seven square pillars, six feet thick, with statues of Osiris before them 23 feet high; the southern gallery also has a ceiling, and is formed by eight round columns. The second propylæum leads to the second court-yard, which is furnished with galleries on three sides. On the eastern side are eight columns, and opposite each column stands a square pillar with a statue of Osiris in front of it. Behind the gallery is a door communicating with the third court, which is separated from the preceding by a wall. The third court-yard, which was probably surrounded by the dwelling

of the king and the royal family, is completely destroyed. A door in the south side of the gallery most likely led to a second building. The columns (*pl.* 5, *fig.* 8), the walls, and the ceiling are covered with hieroglyphics and sculptures, representing the famous expeditions by land and sea of Sesostris, the Egyptian hero, and introducing very often the statue of himself, sometimes riding in his triumphal car, at others slaying his enemies with arrows; but the most remarkable are the representations of a sea-fight, in which the foe are represented as Indians, whilst in the battle scenes on land they are depicted with beards, and therefore are intended to represent Persians. The bas-reliefs in the peristyle represent the triumphal expedition of Sesostris to Arabia, after his numerous victories, as related by Diodorus Siculus.

The world-famed palace of Memnon at Thebes, called the Memnonium, or, by the Romans, Temple of Serapis, one of the most wonderful monuments of the ancient world, has been so effectually destroyed by time, that, notwithstanding repeated investigations, not a single portion of the building itself has been discovered. Still, the colossal statues between the palace of Sesostris and the mausoleum of Osymandias corroborate so far Strabo's description of it, as to remove any doubt that the acacia wood near Medinet Abou occupies the site of the ancient Memnonium.

The colossi of Tamy and Shamy are the most attractive of a large number of fragments of colossi in the acacia wood, numerous enough to decorate all the squares of a large city. Two of them, the northern and the southern, are represented on *pl.* 6, *fig.* 5. Almost all these colossi are formed of limestone or sandstone, granite, or breccia, a material which the Egyptians alone have ever been able to work into statues. The northern of these two colossi, which were probably the largest statues in the Memnonium, is covered with hieroglyphics and with inscriptions in Latin and Greek, proclaiming that the colossus at sunrise emitted a sound somewhat like the breaking string of a harp or a guitar. Cambyses caused this statue to be overthrown and destroyed, for the purpose of examining its internal construction, and of finding out whether the reputed sounds were not a deception practised upon the people by the priests. It is not improbable that the effect of the sun upon the stone was so powerful as to cause a vibration of its surface. Similar sounds are said to have been noticed by the French engineers in the granite apartments of the palace at Carnak. The mutilated portion of the colossus was rebuilt by five courses of sandstone, and the ancient head replaced upon it by the Romans. The statue and base were $48+13=61$ feet high, and weighed about 750 tons. The southern colossus, also somewhat defaced, is formed of a single block of breccia, and between its legs are placed three smaller statues.

The mausoleum of Osymandias is another monument worthy of mention, as it contained 16 colossal statues of Osiris, 29 feet $2\frac{1}{2}$ inches high, and the statue of Osymandias represented in a sitting position, 53 feet 10 inches high, several feet higher than the largest of the Memnon statues. It was cut out of rose-colored granite, contained about 11,965 cubic feet, and weighed about 1,000 tons. After standing for 2000 years, in the year 523 B. C. this statue was thrown down by Cambyses. Opposite to

this was another smaller statue, likewise in a sitting position, which, according to Diodorus Siculus, represented the mother of Osymandias. The second peristyle of the building contains columns of 35 feet 9 inches in height, by 7 feet 6 inches diameter, modelled in a higher style than those in the palace of Sesostris, though the latter was built 800 years after the former. In the second court was a statue of black granite, with a beautiful rose-colored granite head, all in one piece 22 feet high. The head is at present in the British Museum. The bas-reliefs on the exterior walls represent battle-scenes, war-chariots, and attacks upon the enemy's position, who retreats swimming to his reserve on the opposite bank of a river.

Besides the monuments on the left bank of the Nile already mentioned, there were about forty royal tombs, catacombs, or hypogea, only twelve of which can be entered at the present day. They were rock-cut, and are highly interesting on account of their bas-reliefs and fresco paintings. The tombs themselves are generally ranged in different tiers, one above the other; the lowest are usually the most elegant, while those in the upper tiers are very plain. *Pl.* 5, *fig.* 12, shows a ground-plan of one of the largest. In front of the entrance are large fore-courts, which communicate by galleries with the extensive apartments, the largest of which is about 600 feet long, entirely rock-cut. The walls and ceilings are decorated with sculpture-work and fresco paintings, representing vases, furniture, musical instruments (flutes, harps, lyres, &c.) of the most elegant forms, girls dancing to the music of the harp, hunting and fishing scenes, rural occupations, naval scenes, vintage, weighing of goods, a large dinner party seated at a well supplied table, and a court of death. One of the catacombs contains a representation of a royal throne, which most minutely corresponds with the description of that of king Solomon given in 1 Kings x. 19, 20, which was therefore in all likelihood copied from the Egyptian throne. On one of the ceilings a zodiac is painted, by the position of the sun in which it is inferred that the temple was built 1700 years before Christ. Some of the catacombs contain fragments of arches. At the present time they are almost destroyed, and the mummies, divested of their coffins, lie mingled promiscuously together.

It seems to be not out of place here to correct a very prevalent error respecting the art of fresco painting. The term fresco painting, an ancient Egyptian invention, means a painting produced by a chemical preparation of the mortar before and at the time of putting it on the walls, so that it may be affected neither by atmospheric influence nor time, and that the painting executed ages ago may appear as fresh in color and as correct in outline as if done but yesterday. It has nothing at all to do with the object represented or with the beauty of the design, as shown by the great variety in the above mentioned representations. The art of fresco painting is entirely lost to the moderns, and the attempts made in different parts of Europe to rediscover it, sometimes at extravagant outlay, particularly in Munich and in Berlin, have, after several years' experiments, turned out entire failures. It is either simply ridiculous and a proof of ignorance, or an intentional fraud on the public, to dignify by the name of fresco the common water color or oil

painting, such as covers the walls and ceilings of our theatres and other public buildings, whatever may be the subject they represent.

On the right bank of the Nile we see the ruins of a palace near the village of Luxŏr (El-Kusr), standing close to the river upon a platform about nine feet above the surrounding ground, about 2200 feet in length, by 1100 in breadth, and fenced in with brickwork. The ruins consist of a large number of columns, the circumference of some of which is 18 or 19 feet, and that of others about 30 feet, 9 inches. Three obelisks, and the extensive propylæa represented on *pl.* 6, *fig.* 8, indicate a royal palace. In front of the palace was a double row of colossal sphinxes, about 200 in number, which led to the temple, the ruins of which are near the village of Carnak. This avenue of sphinxes is terminated by two obelisks, which, a few years ago, were still standing; they are of unequal dimensions, but both are monoliths of the red granite of Syene. The one on the left hand side, without the point (which is 7 feet long), is 77 feet 7½ inches high, its base being about 6 feet 3⅓ inches in width. The other, without the point of about 4 feet, is 72 feet 6⅓ inches high, with a base of the same dimensions as the first; it weighs about 352,276 lbs. The bases on which the obelisks were placed were of different heights, for the purpose of equalizing the general height of the shafts. The form of these obelisks shows the thorough knowledge of optical effect possessed by the Egyptians. The plane surface of a very slender body, when exposed to a bright sun, appears to be rounded towards the edges. To avoid this, they gave the surfaces a convexity of 15 lines, and this had the effect of making them seem flat, for otherwise one of the edges would have appeared like one half of a cylinder, very bright, and the other entirely dark.

The viceroy of Egypt, Mahomed Ali, presented the two above mentioned obelisks to the king of France. The westerly one was taken down by M. Lebas in the year 1833, and transported to Paris, where it has been erected in the Place de la Concorde. The labors attending the removal began as early as 1829, and the whole work thus took four years. A very interesting model of the progress of the work in all its stages is preserved in the Naval Museum in Paris. The remaining obelisk is intended for the city of Marseilles. Behind the obelisks there were formerly two colossal statues of red and black granite intermixed; but both these monoliths have been destroyed. They were about 42 feet 3 inches high. Between the propylæa, which are 75 feet high, a doorway of 52 feet 4 inches in height leads to a large court yard surrounded by a peristyle. The propylæum is decorated with bas-reliefs, representing warlike scenes. In the court-yard are located the houses of the village of Luxor, the yard being about 169 by 138 feet, with a covered colonnade of 76 columns, 27 feet 7½ inches high. The second propylæum opens to the roof of that colonnade, where the inhabitants were wont to pass the night under tents. The passage from this court to the third propylæum is by a gallery of 14 columns remarkable for their height and thickness, being 10 feet 6 inches in diameter by 62 feet 7 inches in height. They are composed of stone rings filled up inside with bricks, mortar, and cement, with capitals 16 feet 11⅙ inches at the top by 10 feet 9⅓ inches below, and shaped like an inverted bell. The architrave is composed of stone blocks,

each 18 feet in length. The third propylæum opened into a court with a double peristyle of 44 columns in four rows, connected with a portico of 32 columns, to which the side building is attached. The several courts do not lie in a line, the first forming with the large gallery an angle of 3° 9′, which circumstance would indicate that the different parts of the building were originally separate, and afterwards connected by the above mentioned colonnade of 14 columns. This palace, according to Diodorus Siculus, was built by king Busiris about 3100 years before Christ.

The village of Carnak, to the north-east of Luxor, contains the most extensive and magnificent ruins in the Thebaid, and even in the whole of Egypt. Of these, the palace of Carnak, the plan of which is represented on *pl.* 5, *fig.* 7, is the most extensive. *Pl.* 4, *fig.* 4, gives a view of the first court with the second propylæum; *pl.* 6, *fig.* 7, the large hall. This palace, which was situated about 2400 feet from the Nile, was surrounded by a wall 7052 feet long and 30 feet thick, one half of which still exists; the dimensions of the bricks are 12, 6, and 5 inches. From the first propylæum, or from that side of the palace that faced the Nile, there were two rows of sphinxes forming an avenue to the river. Two of the sphinxes are still in existence; they have the body of a lion and the head of a ram, and a symbolical cover enveloping the chest and back. They are placed upon a plinth 12 feet by 3⅓ feet, and 7 inches high, which rests upon a base 10 feet high, and finished with a cima recta. The front, or the propylæum of the palace, is 347 feet 10½ inches long, and 154 feet high. The sculptures upon it are unfinished, and mere rough sketches. In each wing of the propylæum are eight windows in two rows, which correspond with four perpendicular recesses to receive the triumphal poles, like those at the temple on the island of Philæ. In front of the ruins of the entrance are the remains of two colossi in a sitting position, similar to those at the palace of Luxor. The entrance, 20 feet wide, was 60 feet in the clear, and 80 feet high to the top of the cornice, and was closed by bronze folding doors. In the interior of the propylæum staircases led to the different stories, which contained several rooms. This colossal propylæum leads to the fore yard (*pl.* 5, *fig.* 7 *f*), 315 feet 5 inches by 252 feet, with a row of columns on the south and north sides. The latter row, consisting of 18 columns, is in comparatively good preservation, and in connexion with the wall behind it, forms a colonnade covered with stone slabs. The entablature rests upon cubes, which are placed upon the capitals. These columns, represented in *pl.* 4, *fig.* 4, on the left, are 6 feet, 1 inch, and 10½ lines in diameter, and 27 feet, 8 inches, 5⅔ lines in height. The distance between them is somewhat less than the diameter. No bas-reliefs have been found, and the colonnade appears to have been left in an unfinished state. The southern colonnade, eight feet wide, is divided by a building (*pl.* 5, *fig.* 7, *g*) which was probably a temple, a view of which is given in *pl.* 4, *fig.* 4, to the right. The frieze of this gallery contains two rows of hieroglyphics. In the centre of this court there were two rows of colossal columns, each consisting of six. These have all been prostrated, except the last but one in the southern row, but the shafts are not broken. The rows were 42 feet apart. The columns, the most

slender in Egypt, except those at Philæ, are composed of single pieces, each 1 foot, 10 inches high; the full height is 65 feet, 8⅔ inches, with a diameter of 9 feet, 2 inches. The greatest width of the capitals is 15 feet, 4 inches, 8½ lines, their circumference being 46 feet, 2 inches. The shaft and the cube upon the capital are covered with hieroglyphics. Whether the space between the two rows of columns was covered, and if so, whether the ceiling was formed by beams of cedar or by a tent (*velarium*), is a question that has not yet been decided. The French writers are of opinion that statues of the gods were placed upon the columns, and that they did not support any ceiling at all. The temple (*pl.* 5, *fig.* 7 *g*), a portion of the large palace, projects into the court *f*, 36 feet, and had a propylæum 67 feet, 11 inches long, which is very much dilapidated. The central line of the temple is not strictly perpendicular to that of the palace, from which it has been inferred to be of greater antiquity, an opinion which is supported by the fact that the temple is completely finished and covered with hieroglyphics, which are found in no other part of this court. The fore-court has a peristyle, with statues of Osiris in front of the columns; and the court leads to the pronaos, the ceiling of which is supported by eight columns ranged in two rows. This temple, which was probably the private chapel of the palace, is 160 feet long by 65 feet wide. The large court, *f*, contains the ruins of the second propylæum, in front of which were two granite statues. The southern one of these, a monolith, is still in existence: it is 21 feet high, and represented in the act of walking. Seven steps lead to the entrance of the propylæum, which was 20 feet wide, 63 feet, 5 inches high in the clear, and 91 feet to the top of the cornice. It is the largest in the world; the folding-doors were of bronze. The propylæum is nearly destroyed; nothing remains of it but the doorposts, which are decorated with bas-reliefs representing Horus, the symbol of the fructifying sun, and with paintings, the colors of which may still be traced.

The saloon or hall, *e*, 307 feet, 10 inches long, by 154 feet, 5 inches wide, the ceiling of which is supported by 134 columns, is the most astonishing and magnificent edifice of ancient Egypt. It has three divisions. The centre is formed by 12 columns 66 feet high without the entablature, by 11 feet in diameter, the capitals being 10 feet high, 21 feet in diameter, and 64 feet in circumference. All these columns remain entire. The two lateral divisions contain 61 columns each, 40 feet, 6 inches in height, and 8 feet, 6 inches in diameter. The row of smaller columns nearest to the larger ones supports a stone wall with six openings, protected by stone lattice-work, through which the hall is lighted. The ceilings are constructed of stone slabs, almost all of which are 28 feet long, 8 feet wide, and 4 feet thick, weighing about 65 tons each. The architraves are 24 feet long, and 6 feet thick. The shafts of the columns are constructed of courses each 3 feet, 2 inches high, and each course is composed of four pieces, all of them covered with hieroglyphics and symbolical sculptures in recesses. *Pl.* 5, *fig.* 11, represents one of the capitals of the large columns; *pl.* 6, *fig.* 7, the central portion of the hall, with the view into the second court. *Pl.* 5, *fig.* 9, shows another style of capital found in this palace. The capitals of the 122 smaller

columns are similar to the column of Medinet-Abou (*pl.* 5, *fig.* 8), but larger. The ruins of this temple most distinctly show that the stones used in the construction of the palace of Carnak had formed portions of some other building, another proof that long before the erection of those buildings, the ruins of which are now before us, other and similar edifices had been built in Egypt, and destroyed by time.

This hall led to the third propylæum, decorated with symbolic hieroglyphics and bas-reliefs. The entrance door of this propylæum, 49 feet high, leads to a corridor, *fig.* 7, *a a*, which runs round the interior rear part of the monument. Close to the entrance are seen two obelisks of red granite, whose bases are about 5 feet, 7 inches above the present floor, their entire height being 61 feet. They probably measured 70 feet in height from the original floor; their tops are 3 feet in width, by 9 feet in height. The northern has been prostrated and broken, while the southern is still in good condition. Behind these obelisks is the fourth propylæum, which contained a square fore-hall, leading into a gallery, *d, d*, about 80 feet long, by 58 feet wide, with a double row of pillars, at the base of which statues of Osiris are standing. In this room two obelisks were placed, which were among the largest in Egypt, and both monoliths of granite. The southern one is lying broken, whilst the northern one remains in tolerably good condition. It stands 73 feet, 7 inches, 9 lines high, above the rubbish, its entire height being 91 feet, 10 inches. At the base it is 8 feet, 1 inch thick, and where it projects from the rubbish, 7 feet, 7½ inches. It is the highest obelisk of the ten still existing in Egypt, and its weight is about 375 tons.

From the above-mentioned galleries a fore hall of about 18 feet by 37 feet, 6 inches, leads to a dilapidated wall with granite door jambs, probably the ruins of a small propylæum. Two doors lead to two different halls, the walls of which are decorated with highly elaborated symbolic sculptures. In front of the sanctuary (*fig.* 7, *c*) were two truncated obelisks (*steles*), 7 feet, 7 inches high, which probably served as pedestals for busts. A door between them leads to the granite apartments, the walls of which are covered with well finished and painted bas-reliefs, frequently representing Horus, the son of Osiris and Isis. The blue color is still quite fresh and brilliant. The ceiling, constructed of granite and sandstone blocks, is decorated with yellow stars, with red centres on an azure ground. To some of these granite apartments small chambers were attached, decorated with sculptures representing the inauguration of kings by the priests, and sometimes the sacred boat. It is generally supposed that none but the kings and priests were admitted into these chambers. In the granite apartments the French engineers frequently noticed sounds similar to those attributed to the statue of Memnon; they always seemed to originate from the granite ceiling, which probably vibrated in consequence of the sudden changes of temperature, the nights being very cold, and the days exceedingly hot. About 500 feet behind the granite apartments are found some more ruins (*fig.* 7, *b*), which probably constituted a portion of the palace. They form a hall, the centre ceiling of which rests on 20 columns arranged in two rows, which are surrounded by a peristyle supporting a lower ceiling; the whole being a miniature copy of the large

hall (*pl.* 5, *fig.* 7 *e*), probably the room in which the inhabitants of the palace held their meetings. Behind this is another hall, 88 feet long by 49 feet wide, the columns of which are remarkable on account of their 16 flutes, and probably gave the idea of the Doric column. Besides these mentioned above, the palace contained a number of smaller rooms. According to Herodotus and Diodorus Siculus, this palace was built at the time of king Busiris II. that is, about 4500 B. C.

Several other ruins are situated at the southern and northern ends of the inclosure of the palace, but they consist of little more than a few woman-headed sphinxes with the bodies of lions, the number of which originally amounted to about 60; among them the largest in the Thebaid (See History, Plates, Division IV. *pl.* 3, *fig.* 32).

The ruins of Tentyra, or Denderah, which occupy an area of 2300 feet by 2400, and contain the northern temple, the temple dedicated to Typhon (Typhonium), the large temple, and the southern temple, are classed among the most elegant specimens of Egyptian architecture. The northern temple, not over 50 feet by 34, is peripteral, with 14 columns, and has not been completed. The Typhonium, a temple dedicated to the evil principle, also peripteral, is 105 feet by 55 feet, and similar to the temple at Edfou. Leaves of the lotus and other plants ornament the capitals, whose cubes show on all four sides the image of a typhon, enveloped in lotus leaves. Another Typhonium of great interest is situated on the mountain of Barkal. It is partly excavated in the rock, and contains two rooms. In the first, or pronaos, next to the propylæum, the architrave is supported by four rows of pillars, four in each row; in front of each pillar is a statue of the god Typhon, supporting a kind of cushion, upon which the architrave rests. *Pl.* 4, *fig.* 8, shows a perspective view of the interior of this pronaos.

The large temple of Tentyra was 245 feet long, by 128 feet wide, and 55 feet high. The entrance door is 15½ feet wide, and the ceiling of the portico (*pl.* 4, *fig.* 5 *a*) rests upon 24 columns ranged in four rows, the capitals of which are composed of four heads of Isis, which support a cube, on the faces of which temples are represented (*pl.* 5, *fig.* 10.) The colossal head is partly hidden by a drapery painted with longitudinal stripes, exhibiting lotus leaves and pearls. The sculptures upon the cube represent offerings to Isis, who is nursing her son Horus. All the columns are covered with hieroglyphics. The door jambs, like the building itself of sandstone, are framed in by the centre columns; the head-piece over the door is of granite. The walls of the portico are inclined on each side, to the extent of 10½ feet. The rear portion, or the main temple, is about ten feet lower than the portico. It contains a ceiling painted with yellow stars on a blue ground; and also the famous zodiac, explained in the mythological part of this work. This zodiac is cut in stone; it begins with the lion, and ends with the scarabæus in place of the crab, the constellations ranged around it. On the ceiling of the portico, are similar decorations executed in painting. The two corner pillars on the front (*pl.* 4, *fig.* 5 *a*), are ornamented with four rows of bas-reliefs representing the offerings of gifts to Osiris and Isis, the former of whom is represented sometimes with the head of a boar, sometimes with

that of a sparrow-hawk, or of a falcon. On the inside of these pillars are figures 15 feet high; and from each side-wall of the temple project the heads and half the length of the bodies of three lions. The wall between the front columns is ornamented with bas-reliefs representing offerings to Isis. In one of the rooms are sculptures relating to the death and resurrection of Osiris, probably a symbolical allegory of the decay of vegetation in the dry season, and its renewal after the inundation of the Nile.

Upon the terrace of the main temple stands another smaller temple, a circumstance unique in Egypt; its columns are copies on a smaller scale of those of the main temple.

The southern temple of Tentyra presents nothing of particular interest. Judging from the zodiac, the monuments of Tentyra were built about 2500 years before Christ.

Two colonnades, which are scarcely accessible, mark the site of the ruins of Abydos, where Memnon had a palace, and Osiris a temple. They are ornamented with sculptures, and the ceilings are painted with yellow stars upon an azure ground. Further down the river we find the ruins of Antæopolis, composed of a large temple, with its inclosure, and on the west a temple with a quay-wall towards the Nile. *Pl.* 4, *fig.* 1, represents the ruins of the large temple of Antæopolis. The portico of 18 columns, ranged in three rows, was 135 feet long and 45 feet high. The ruins, which are in a very dilapidated state, are situated in a date grove; and the capitals of the columns are ornamented with date leaves. One hundred and eighty feet distant from the portico is a monolith temple of limestone, 15½ feet high. According to a Greek inscription upon the architrave, the temple was rebuilt by Antoninus and Verus.

On the ruins of the ancient Besa the emperor Trajan erected a city, which in honor of his friend Antinous he called Antinopolis or Antinoe; and the ruins of this city being therefore of a more recent date, present some of the characteristics of Grecian and Roman architecture. The remains of the theatre contain Corinthian columns (*pl.* 4, *fig.* 2). Below Antinoe, near Sandah and Beni Hassan, are rock-cut tombs, one of them containing fluted columns, 3½ feet thick and 7 diameters in height, with 15 flutings, undoubtedly of ancient Egyptian origin.

The catacombs of Alexandria (*pl.* 5, *fig.* 13 a plan, and *fig.* 14 a section of the catacombs) contain eight Doric columns, which support the arched ceiling of the centre room, to which the four mausolea are attached.

The pyramids deserve the name of eternal abodes of the deceased as well as the rock-cut tombs. These structures are of Egyptian origin, although they are met with in India and in Nubia, for instance near Assur (*pl.* 6, *fig.* 4), and even in Egypt they have only been erected in the district of Fayum, and in the tract of the Libyan mountains, which is at present occupied by the villages of Gizeh, Sakkarah, Dashour, Megduneh, and El Metanjeh, near the ancient Memphis and Busiris. Of late it has been surmised that they were intended for astronomical purposes, as the direction of the different passages in the interior has been observed to correspond with certain astronomical lines.

King Mœris seems to have been the first to erect buildings in pyramidal form; for on digging the lake which is called after his name, he built some large structures of this kind in the very middle of it (*pl.* 6, *fig.* 1). Much later, about 1000 B. C., Cheops built the largest pyramid near Memphis, the present Gizeh; the second was built by his brother Chephrenes; the third by Mycerinus, son of Cheops; and Asychis, his successor, erected the fourth. These, together with three smaller pyramids dedicated to the queens of the above mentioned kings, and to the daughter of Cheops, are known as the group of Gizeh (*fig.* 2). The pyramids at Sakkârah and in the other places were built about the same time with the others. In the neighborhood of the group of Gizeh is situated the far-famed colossal Sphinx (*fig.* 6). *Fig.* 3 shows a section of the largest pyramid at Memphis. The pyramids were constructed either of bricks or of stone. The fourth pyramid, and those in the lake Mœris, belong to the former class, and have been almost destroyed; the latter, which was originally 240 feet high, being now not more than 180. The majority of them were constructed of limestone, which was found in the vicinity, or of Trojan or Ethiopian granite. Some of them exhibit pieces of yellow and red marble. With very few exceptions, the edges of the pyramids are directed towards the four quarters of the heavens. The proportion between the extension of the base and the height seems to have been strictly regulated; the line from the base to the top is not always straight, being in some instances curved, in others broken by terraces of different heights; the one near Sakkârah having six terraces of equal height. Some of them run to a point at the apex, while the tops of others are formed by platforms of different sizes. The dimensions of the pyramids are also equally various. According to the report of Girard, the pyramid of Cheops was 699 feet, 9 inches long at the base, and 425 feet, 9 inches high; the pyramid of Chephrenes, 655 feet base, by 398 feet in height; those of Sakkârah are a little smaller.

Herodotus informs us that it required the labor of 100,000 men during ten years to construct the embankment for the transportation of the stone blocks to the pyramid of Cheops, and afterwards the same number during twenty years to erect the pyramid itself. The latter operation was conducted by first building one terrace, and then raising all the materials for the next one, up to this; the angles between the terraces being filled up, and the surface of the pyramid smoothed afterwards. The construction of the large pyramid of Memphis (*fig.* 6, view, *fig.* 3, section) is as follows: The first course of stones rests upon the main rock, and was imbedded in it to the depth of seven or eight inches. The rock was then cut so as to form a plinth, five feet high, which is 100 feet above high water of the Nile. Above the first course of stones are twenty others cut into steps 9½ inches wide to one foot rise. The two uppermost courses have been destroyed; and the whole height, plinth and top included, is nearly 450 feet, the base being 716 feet in length. Each block is fitted into the adjoining one without the least irregularity, the lower stone receiving in a groove two inches deep, a projection of the upper one of the same size. The four angles of this pyramid point exactly to the four quarters of the globe, a thing not easily done even at the present day; it

establishes, however, one remarkable fact, viz. that during the thousands of years which have elapsed since the erection of this pyramid, the position of the axis of the earth has undergone no change whatever.

The entrance to the pyramid is at present on the north-eastern side, upon the 25th course, and about 45 feet above the base. It is represented on *pl.* 6, *fig.* 3. Having been closed with brickwork it was only accidentally discovered. A gallery sloping downwards, leads to a passage 3 feet, 5 inches in width and height, and 102 feet long, the entrance to which was blocked up by a large piece of granite which could not be removed, but a passage has been made around it. At the extreme end of this gallery is a platform, and on the right hand side a well cut in the rock, about 200 feet deep, but without water, even as low as 50 feet below the level of the Nile. Its extreme depth has, however, not been reached. At this floor a level passage branches off, about 118 feet in length, which leads first to a room called the queen's apartment, which is 17 feet 10 inches in length, by 16 feet, 1 inch wide, and empty; second, to another gallery, 125 feet long, 25 feet high, and 6½ feet wide. On each side of this are benches 21 inches high by 19 inches wide, and at the end is another platform, communicating with another opening, 3 feet, 3 inches wide, 4 feet, 5 inches high, and 7 feet, 10 inches long, forming the entrance to the upper room of the king, which is 32 feet wide, 16 feet long, 18 feet high, and covered with polished granite, the southern side being the longest. At the western end is the granite sarcophagus, 7 feet, 1 inch long, 3 feet, 1 inch wide, 3 feet, 6 inches high. It is empty, and lies due north and south; the lid is wanting.

Near this pyramid is situated a figure of the Sphinx (*pl.* 6, *fig.* 6). It is cut from the rock on which it stands, and is still connected with it. Its height to the back is about 40 feet, and it was necessary to remove masses of rock to lower the surrounding ground, in order to exhibit its full dimensions. The figure is 117 feet long; the circumference of the head is 91 feet, the height from the belly to the top of the head 51 feet. There is an opening in the head in which the head-dress was fastened. The French, during the expedition to Egypt, after removing the surrounding sand by which it was covered up to the neck, discovered an opening between the fore legs of the figure, which soon proved to be a regular entrance, communicating by subterraneous passages cut through the rocks with the large pyramid. This accounts for there being no outer entrance to the pyramid, and for the different branches of the afore-mentioned galleries being secured by blocks of stone from the opposite side. At the same time also, it proves that the ancient Arabian authors were not mistaken in asserting that the different galleries and wells in the pyramid communicated with an entrance through an opening in the figure of the sphinx.

From this short account of the remains of ancient Egyptian architecture an idea may be derived of the state of civilization of the nation which created it. Our highest admiration is due to the noble monuments of the talent, industry, and perseverance of a people, who maintained for hundreds and thousands of years an imposing style of architecture, uncorrupted and unchanged, and to whom the other nations are indebted for the transmission

of the written alphabet, and for many valuable principles and ascertained facts in Geometry and Astronomy. It cannot be a matter of wonder that such a people should have spread its dominion over a vast territory, and have important colonies on the Euphrates, in Greece, and in other countries, and that its genius should have influenced the most talented and eminent men of ancient Greece.

3. Assyrian, Median, Babylonian, and Persian Architecture.

The city of Nineveh, situated on the banks of the river Euphrates, was the metropolis of the kingdom of Assyria, which originally comprised the tract of country bordering on the rivers Euphrates and Tigris. But the Medes and Babylonians afterwards declared themselves independent, and formed two new kingdoms. The chief city of the former was Ecbatana, of the latter, Babylon. After the destruction of Nineveh and the incorporation of the kingdom of Assyria with that of the Medes (600 B. C.), the kingdoms of Babylon and Media were continually contending with each other, until they were both conquered by the Persians, under Cyrus, the founder of the great Persian Empire.

Nineveh, which almost exclusively furnishes the materials for the study of the architecture of the Assyrians, has only within a very short time been excavated from the rubbish by which it had been covered for ages. According to Herodotus, it was built in the form of a quadrangle, which was 40 geographical miles in length, by 13 miles in breadth. It was inclosed by a wall wide enough for three chariots to drive abreast, 100 feet high, and containing 1500 fortified towers of 200 feet in height. This wall was probably built of sun-dried bricks, since the conquest of the city was rendered possible by the destruction of a large portion, in consequence of an inundation of the Euphrates. The most important remains brought to light by the latest excavations are some colossal sculptures from the royal palace (*pl.* 3, *figs.* 1 and 2).

Ecbatana, the metropolis of Media, and the summer residence of the Persian kings, was built by Dejoces 700 B. C., upon a hill which was fortified by seven terraces or walls of mason-work, each with battlements painted of a different color. Alexander the Great, according to Ælian, when his friend Hephæstion had died at Ecbatana, caused these walls to be pulled down.

Our knowledge of the history of Babylon is not quite so scanty as that of Assyria; still we are acquainted with but few buildings except those of the city of Babylon, a city whose erection is due to several sovereigns, and particularly to the two queens Semiramis and Nitocris. It was situated in a fertile plain on the Euphrates, and formed a square of 81 square miles, giving a circumference of 36 miles, surrounded by a wall, which according to Pliny was 200 feet high, and according to Strabo 32 feet wide, though others assert that it was 400 feet high by 50 feet in width. The two faces of the wall were of bricks laid in bitumen, thirty bricks thick, and strength-

ened by buttresses; the space between being filled up with bundles of reeds compacted by bitumen. This wall has been mentioned by us under the head of Military Sciences (Fortification), and a view and section of it given in illustration. (See Plates, Division V. *pl.* 42, *figs.* 12 and 13.) It had 100 entrances with metal gates, jambs, and lintels. There was a second wall inside the other. The river Euphrates divided the city into two parts, which were connected by several bridges, constructed of beams resting upon stone piers. The buildings were generally three or four stories high, and the streets crossed each other at right angles. The royal palace is situated on one bank of the river, and the temple of Belus on the other. The hanging gardens formed part of the palace grounds. They were erected by Nebuchadnezzar for his queen, who, as a native of Media, had a predilection for mountains. These gardens were laid out in a series of terraces constituting a hill 75 feet high and 1600 feet in circumference. The terraces were supported by walls 22 feet thick, and 10 feet apart, which were covered with stone plates 16 feet long, and 4 feet thick. Upon these plates was first laid a coating of bitumen, followed successively by a layer of bitumen and reeds, a double course of bricks in mortar, and finally a sheet of lead. The soil was then spread upon this substratum, of the proper thickness for the proposed plantations. The spaces between the walls formed large rooms for festal occasions, and were lighted from the projecting terraces. On the top was a reservoir, the water for which was drawn from the Euphrates by means of a hydraulic machine, and carried in pipes to all the different parts of the grounds. There was even a sufficient supply for a few fountains. The height of each terrace was 12½ feet, and the width 64 feet.

The temple of Belus formed a square of about 600 feet in length, in the centre of which was erected a tower 300 feet square. This tower was composed of eight stories, and a staircase was led up on the outside. The uppermost story contained the temple hall, where a maiden favored by the god nightly slept. In the lowest story was another hall, in which stood a colossal statue of Jupiter 24 feet high, of massive gold. The throne with its steps, and the table before it, were likewise of pure gold. An altar of gold and another of stone were placed in front of the temple. These treasures were all taken away by Xerxes.

The principal feature of Babylonian architecture is its bold, massive character, and colossal dimensions. The water works of the Babylonians, too, were second in importance only to those of the Egyptians. Their fortifications are really surprising. The temple of Belus was as large as any of the pyramids, though not so difficult to construct, as it was built of bricks. The outer walls of the Babylonian buildings were either coated with bitumen and painted, or the surface of the bricks was glazed. Only a few works, chiefly the dams and sluices on the Tigris, were constructed of stone blocks, on account of the great distance they had to be carried. The arch was not known to the Babylonians. In cases where a frame ceiling could not be erected, they had recourse to immense stone slabs. Metal was frequently used, particularly for doors and jambs.

The Persians, who, before the time of Cyrus, were a people of inferior

cultivation, and dependent on the Median kings, began to acquire a knowledge of the fine arts after they had invaded northern and western Africa and Egypt. Cambyses, together with the treasures which he carried home from Egypt, brought Egyptian artists to Persia, to build the royal palaces at Persepolis, Susa, and in Media. But no actual improvements in the arts were made in Persia; and they remained in the same condition in which they were when Cambyses and Darius first introduced them. Almost all the artists of Persia were foreigners.

The buildings of Ecbatana were mostly of brick laid in bitumen; marble or other valuable stones were used for columns and floors.

Pasargada was the most ancient fortress of the Persian kings, and Cambyses ordered the corpse of Cyrus to be brought thither, and an expensive mausoleum to be erected over it. The substructure was a square of stone blocks, accessible by seven marble steps; the main building was erected of timber and bricks. In the interior were the golden coffin of Cyrus, his golden bedstead covered with rich carpets, and a table of gold with the royal garments and arms. The building still exists, and is called the mausoleum of the mother of Solomon. It is 43 feet long, 37 feet wide, and 42 feet high. It is quadrangular, and has a gable roof.

The city of Persepolis was magnificent both in plan and in execution. *Pl.* 3, *fig.* 11, shows a portion of the royal palace. It was surrounded by three walls, the first 32 feet high furnished with battlements, the third 120 feet high, and built of stone. It inclosed a quadrangle, on the eastern side of which was the rock with the royal tombs, which had no proper entrance, being cut in the rock; the corpses were elevated by machinery, and thus deposited in their appropriate places. On one side of these ruins, which are about six miles from the ruins of Shehel-Minar, are fragments of two porticoes which stood at right angles to each other, and formed an entrance to a larger flight of stairs leading to another portico, composed of a double row of six pairs of columns, behind which was situated a spacious court-yard surrounded by colonnades. The two first-mentioned porticoes had colossal pillars on either side, at the foot of which stood the fabulous animals which are represented on *pl.* 3, *figs.* 9 and 10. *Fig.* 9 somewhat resembles the Egyptian sphinx, but in Persia the head of a priest was substituted for that of a female. *Fig.* 10 was probably intended for a horse or unicorn, which is frequently mentioned in the Persian mythology. Between the two pillars were four double columns, the bases of which are shown in *figs.* 7 and 8. The capitals were formed as in *fig.* 5, surmounted by horses (*fig.* 6), which supported the entablature in the manner represented in *fig.* 12, where unicorns replace the horses. The capitals of the second portico were plain (*figs.* 3 and 4). The porticoes had ceilings of stone-slabs.

The fronts of the royal tombs, known as the ruins of Nakshi Rustam, were built of a hard dark stone, in large blocks, very closely jointed; and the columns were of white marble. Figures in bas-relief, with inscriptions in arrow-head writing, decorate the walls. *Fig.* 12 shows the elevation of one of these tombs, the entrances of which were blocked up after the corpse had been deposited. It has not yet been ascertained whether there

was any means of access by an inner passage. The figures upon the walls represent, besides mythological animals, long arrays of warriors making war upon lions, unicorns, &c., evidently under the command of the king, whose likeness is often introduced. The tomb in *fig.* 12 is that of Darius. It exhibits a high, splendid scaffolding, supported by curiously-shaped figures of the unicorn, and between them two tiers of telamons, or pilasters shaped like men, supporting a weight on their raised hands. Two priests on duty stand at the foot of the scaffolding, and guards are drawn up on each side. Upon the scaffolding is the altar with the sacred fire, in front of which, elevated by a few steps, stands a figure with one hand leaning upon a bow. The other hand is upraised, and the face gazing towards the fire. Above, between the hearth and the worshipper, is a soaring figure, only half visible, which in the right hand holds a wreath, whilst the left is lifted as if in benediction. Behind it is seen a globe suspended over the fire. The figure with the bow represents the king under the protection and in sight of the divine beings, Oromasdes and Mythras, worshipping the sacred fire.

Persian Architecture bears traces of its Egyptian origin throughout; in the selection of building sites, in the style of ornaments of the door caps, the decoration of the walls, in the character of the sculptures, in the inferiority of their drawing, and in the practice of representing the person of the king always taller than all the others. After Darius had invited Grecian artists to Persia, the monuments of that and of the following ages frequently bear traces of Grecian designs. The best proof of this is the elevation of the mausoleum of Darius, and all its details.

4. Grecian Architecture.

1. *General Considerations.*

The first structures devised by man for protection against the weather were huts half sunk in the ground, with the upper part formed by posts covered with earth and leaves on the outside, and on the inside with the skins of the animals which had supplied food for the inhabitants of these structures (*pl.* 7, *fig.* 1). The inconveniences of these primitive dwellings soon became manifest; they not only did not afford sufficient accommodation for the increase of families, but they offered very indifferent shelter from wind and rain. To remedy these disadvantages was the next step, and the enlargement of the capacity of these structures led to the use of more substantial materials. Instead of posts they took whole trunks of trees, and entirely inclosed the site of the intended building, placing them close together either in a horizontal or perpendicular position. Other trees were put over these to form a ceiling, and thus originated log houses. From the great consumption of wood it soon became necessary to observe economy in its use, and the perpendicular logs began to be separated by intervals, connected only by horizontal pieces. A similar change was made with those on which the roof rested. The latter were afterwards covered with boards and earth,

and the openings between the perpendiculars were closed with a mixture of earth and loam (*pl.* 7, *fig.* 2). Such a building was not impervious to water. In order to obviate the leaks in the roof, a triangular frame was constructed, to which the boards of the ceiling were attached (*fig.* 3 *a*). A structure of the above description, notwithstanding its rudeness in a scientific point of view, contains all the different parts of a modern building, viz. a roof composed of rafters, a tier of beams, and posts or supports underneath. Partly in order to protect the lower portion of the posts from the effects of rain, &c., partly from a taste for ornament, the idea was conceived of surrounding the lower part with a few extra boards, or else of setting the post on a support prepared for the purpose, instead of fixing it in the ground; and thus the *base* of the column originated. On the other hand, top pieces were laid upon the posts for the better support of the top cross-beams (the *architrave* of later buildings), and these top pieces were the germs of the *abacus*, or the blocks surmounting the capitals of columns. To protect the ends of the beams against the rain a board was fastened to them, in which little gutters were cut to allow the water to run off; thus arose the *triglyphs*. The spaces between the different beams were also filled up, and hence originated the *frieze*. Finally, to carry the water running from the roof clear of the beams, the rafters were made to project beyond the uprights, and a board was fastened to them, which formed that portion of an entablature afterwards called the *cornice*. *Pl.* 7, *fig.* 3 *b*, exhibits a skeleton of such a building.

The above-described mixture of earth and loam used to fill up the intervals between the different uprights, was soon found to be too frail to protect the inhabitants from the weather, or from the attacks of wild beasts, much less from the assaults of their human foes. They were therefore obliged to seek some other material, and they very early began to make use of stones, which were found almost everywhere in large quantities. The use of this new material being once commenced, in a remarkably short time people began to employ it not only for their dwellings, but also for marking the divisions of lands; and not only did they manage stones that were easily portable, but large blocks of extraordinary dimensions. Their walls, which were put together without any cement whatever, are known as Cyclopean constructions, and to this day they command our admiration and surprise. Almost all the earliest strongholds were surrounded by such walls, the strength and durability of which are evidenced at Tiryns, and several other places. At a later period the interstices between the larger blocks were filled up with smaller stones, and gradually the stones were hewn square, and good workman-like walls, like those at Messene, were constructed. The entrances at this period were mostly pyramidiform, and in some we can trace rudiments of towers of defence. This form of construction passed through various phases of development into the regular bound masonry, or construction with rectangular blocks of stone; but for the substructure polygonal blocks, or rectangular ones with bevelled edges, were retained through almost all periods. The bound masonry was in time superseded by brick-work. We find, then, in ancient times the following manners of con-

struction: 1. The irregular work, *opus incertum* (*pl.* 7, *fig.* 7), constructed of stones of various shapes, but of about the same size, and cemented with mortar. 2. The flat square work, *opus quadratum* (*fig.* 8) of the Greeks, where the surfaces of all the stones are of equal size, and rectangular. 3. The facetted square work, as in the forum of Augustus (*fig.* 9), and in the tabularium (*fig.* 10), where the faces of the square blocks project, the edges being bevelled off; the joints are thus sunk in. 4. The net-work, *opus reticulatum* (*fig.* 6), where only the corner blocks are set horizontally, all the others being laid diagonally. 5. Brick-work in even courses, *opus isodomum* (*fig.* 11), where all the courses are of the same thickness. 6. Brick-work in uneven courses, *opus pseudisodomum* (*fig.* 12), where thick and thin courses alternate.

In constructing very thick walls, the two outer faces only were laid symmetrically, the space between being filled up with mortar and small stones; such walls were called filled walls, *emplecton*, and of these there were three different kinds: 1. Where the two faces (*fig.* 13 AA) are built without any connexion, and the space, B, between them is filled up. 2. Where the bricks in the faces are laid alternately as headers and stretchers (*fig.* 14, upper part), the latter thus affording a firmer connexion of the two faces, by projecting into the rubbish between them (*fig.* 14, lower part). 3. Where some of the bricks are stretched through both faces of the wall. Walls of this description are even constructed nowadays, but they ought always to be considered as very inferior work.

THE COLUMN. After the walls were built of stone, the wooden posts of course soon gave way to stone pillars. These were at first short, and therefore in a single piece; but it soon became necessary to have them longer than single stones could conveniently be procured, in consequence of the increased height of the buildings, and they were then constructed of several disks (tambours) placed one on the other. The quadrangular pillar, however, in no long time must have become offensive to the eye accustomed to the circular forms of trees, and the stones were rounded to form the column. After a time, the upper part of the column, or more properly the block which was placed on the top to afford a better bearing for the beams, was moulded into an oval or convex shape, the *echinus* (*pl.* 19, *fig.* 1). To form a more tasteful connexion betweeen the column and the echinus, a few horizontal stripes were made in the lower part of the top piece (*pl.* 20, *fig.* 9, left lower diagram), and another stripe was afterwards cut in some inches below, and so the neck of the column was formed. The mouldings of the stripes and of the echinus itself are sometimes a little different, as shown in the several Doric capitals (*pl.* 19, *figs.* 1, 2, 3). To give the column greater strength and stability, it was made wider at the foot than at the neck and capital, and to make it appear lighter it was channelled with perpendicular stripes, and hence the origin of the *flutes*. These flutes were sometimes put close to each other (*pl.* 19, *fig.* 1), or a small ridge was left between them (*fig.* 7). Sometimes the shaft was left plain (*figs.* 4), and at a later period the column itself was decorated with foliated work (*fig.* 25, 26). Some of the Doric columns have flutes of a few inches in length close below the

neck, and others of the same length at the foot, the remainder of the shaft being left plain (*pl.* 19, *fig.* 2). Columns of this description, when first met with, were considered unfinished, but after they had been observed on monuments under circumstances which absolutely excluded the idea of an unfinished column, the opinion was established that they were purposely so formed, and these columns were called mantled columns. The introduction of human figures as supports of the entablature, instead of columns, was made at a later period, in order to convey the idea of the submission of the nations conquered by the Greeks, namely, the inhabitants of Caria and Persia. Hence the figures which represent females are called Caryatides (*fig.* 31), while the male figures are denominated Persians (*fig.* 30), and when naked Telamons. Buildings constructed with figures instead of columns are styled stalagmatic. In all the foregoing kinds of columns, which belong to the Doric order, the base of the column neither projects, nor is it moulded or decorated at all, the column standing immediately upon the ground (*pl.* 20, *fig.* 8).

The second kind of Grecian capital is the Ionic (*pl.* 7, *fig.* 22). It is more chaste and elegant than the former, and different accounts are given of its origin. Some think that as the capital is the head of the column, the volutes on both sides of the echinus are intended to represent the ringlets of an Ionian maiden; while others are of opinion, that some builder having casually placed a piece of bark between the echinus and the abacus, which upon drying became curled into a pleasing shape, this addition was afterwards imitated in stone (*pl.* 21, *fig.* 4). The profile (*pl.* 7, *fig.* 24) shows how the two volutes are connected by a kind of cushion; the echinus is small, and decorated with serpents' eggs (*pl.* 19, *fig.* 7). Columns of a very rich and elaborated character have a decorated neck below the volutes called *hypotrachelium* (*pl.* 19, *fig.* 6, *a*, *b*, and *pl.* 7, *fig.* 24). The Ionic column, being more slender than the Doric, always has a base.

The third class of Grecian capitals is the Corinthian. It is said, that Callimachus, a sculptor of Corinth, on observing some acanthus leaves which had grown up round a basket that had been left upon a grave, and had bent over after reaching the top (*pl.* 7, *fig.* 5), was so delighted with the beauty of the picture that he imitated it in stone for a capital, which became the prototype of the Corinthian capital. Egyptian monuments, however, show capitals so similar in shape to the Corinthian, and certainly much older, that it is probable that the Greeks did not invent what they found ready at hand to imitate; the more so as they brought most of their information from Egypt in colonizing their country. The Corinthian capital admits of a great variety of decoration (*pl.* 19, *figs.* 9–13), and there are scarcely two buildings of that order without some difference in the capitals.

The base of the Corinthian order is the same as that of the Ionic, but the column itself is more slender. The top of the shaft is always smaller in diameter than its lower part. In some cases the reduction is effected in a straight line from the base to the cap. Optical considerations have, however, led to the better plan of either giving to the lower part of the shaft, up to about one third of the height, an uniform diameter, the reduction then

commencing, and being continued from thence upwards (*pl.* 20, *fig.* 10); or of giving it the largest diameter at the height of the human eye, and reducing it from this point both upwards and downwards (*fig.* 11). The greatest diameter of columns of the latter description is called the swell (*entasis*).

The columns are placed either on single stone cubes, or on a continuous plinth (*stylobates*). The space between the columns is styled the columnar distance, and varies very much. Different terms are applied to the various distances. If the space between the columns be equal to 4 diameters they are said to be placed distantly (*aryostylos*); if the space be equal to 3 diameters, widely (*diastylos*); if $2\frac{1}{4}$ diameters, beautifully (*eustylos*); if 2 diameters, closely (*sistylos*); and if only $1\frac{1}{2}$ diameters they are said to be thickly placed (*picnostylos*). As a general rule the two corner columns are for optical reasons placed somewhat nearer together than the others of the same row. Another contrivance, intended to correct an optical delusion with regard to colonnades, is mentioned by Vitruvius by the name of *scamilli impares*. According to this author on ancient Roman architecture, a row of columns standing on a substructure would, when viewed from a distance, appear convex, and elevated at both ends, and this effect would be averted by the *scamilli*. Unfortunately, all the drawings which might have illustrated the works of Vitruvius have been lost, and as, moreover, the ancient Roman buildings exhibit no architectonic moulding which seems to serve the purpose ascribed to the *scamilli* by Vitruvius, his commentators are greatly at variance in their explanations of the idea he means to convey. Most of these learned men agree in this, that the *scamillus* was a distinct moulding, which being placed above and below the column, would make it appear to recede. Some columns found among the ruins of the theatre at Laodicea seem to corroborate the correctness of this view. *Pl.* 7, *fig.* 19, shows one in connexion with the substructure and architrave, and *figs.* 20, *a*, *b*, one of a different order on a larger scale. We see here at A and B small mouldings inserted above the top of the capital and under the foot of the base. The latter is slightly higher on one side, producing the impression of a slight inclination in the column; the upper one has a similar excess of body on the opposite side, apparently levelling the slanting surface of the capital, and supporting the entablature with its full surface. But other authors say, that these small mouldings had no other object than to relieve the mouldings proper of the base and capital. Still others maintain that Vitruvius originally wrote *camillum* and not *scamillus*, and that he applied it to the columnar distances, which were to decrease as they receded from centre, and in proportion with them the pannels in the substructure (*camilla*) were to be reduced in size (*fig.* 15). One commentator, Bertanus, is of opinion that a moulding introduced in the base (*fig.* 16, c) would produce the effect ascribed to the *scamilli impares;* and another, Placentius, follows this view, but places the moulding as in *fig.* 17, D. Both make the mouldings a little higher at one of the sides. Blanconius, finally, explains *scamilli impares* as applied to the inequality of the side walls of the flights of steps leading to the colonnade, and supposes that the first ought to be the highest

(*fig.* 18, G), whilst the following gradually become smaller to the top of the flight.

It would appear that none of all these views are entirely satisfactory. A better explanation of the whole subject seems to be afforded by the latest discoveries in re-surveying the Parthenon and the temple of Theseus in Athens. It was there found that the steps upon which the columns rest are slightly convex towards the centre, both in front and on the top, and the different blocks of which the columns are composed are not put together in horizontal joints, but are a little out of level so as to give the columns a slight inward inclination. The upper surface of the top block is again placed in exact level, in order to offer support to the architrave. This arrangement seems to serve the same optical purpose as the slight convexity of the surface noticed in the Egyptian obelisks.

The object of architectural mouldings generally is, either to separate the large masses of a building, or to form a connexion between the several distinct parts, and to protect by their projection the plane surfaces and recesses of the buildings. The mouldings are either straight or curved. Among the former we distinguish: 1. The *fascia* or stripe, a continuous even surface projecting from the main surface, and whose height must not exceed $\frac{1}{3}$ to $\frac{1}{2}$ diameter of a column. 2. The *tænia* or fillet, similar to the fascia, but only half its height. 3. The *quadra* or socle, which is very narrow, and is called the *supercilium* or slab, if it is at the uppermost moulding, or the cover. 4. The *face* or slanting plane, which connects two perpendicular surfaces in a diagonal line.

The curved mouldings exhibit a greater variety, viz. 1. The *torus* or cushion, which is nearly a semi-cylinder, somewhat pressed out at the lower edge. 2. The *echinus* or ovolo, which exhibits a curved outline nearly the reverse of the torus, being more swelled at the upper edge. It is an independent supporting member, whilst the torus serves as an assistant to other mouldings. 3. The *quadrans* or cavetto, whose outline is a quarter of a circle. 4. The *astragalus* or bead, which is a very narrow moulding of a semicircular outline, and generally serves to separate the capital from the main column. 5. The *striæ* or flutes, which are concave mouldings, whose outlines are segments of a circle, rarely a semicircle; they are wrought in columns or pillars, connecting the bases and capitals; on columns they are generally narrower at the top; sometimes the flutes are separated by ridges (*striges*). 6. The *cymatium doricum* or wave, whose profile is a concave quadrant; it is applied either erect or reversed; in the former case, the curve projects from the main surface, whilst in the latter it recedes. 7. The *trochylus* or scotia, similar to the last, but not exactly a quadrant, being composed of two different segments (*pl.* 20, *fig.* 14). It is applied both erect and reversed. 8. The *apophygis* or quirked moulding, a small acute channel or recess used between mouldings; the reverse, or the projection, is called *apothesis*. 9. The *cyma lesbicum*, or bell moulding, a combination of a concave and a convex quadrant; it is applied erect or reversed; in the former case the upper half projects, in the latter it recedes.

The different mouldings were in earlier times decorated with painted

ornaments and this is even sometimes done at the present day, but at the flourishing age of the art bas-reliefs superseded the painting, and in all edifices of true merit bas-reliefs are still retained.

The columns are among the most important architectonic pieces, and as we have seen, generally composed of the base, the shaft, and the capital. The Doric column is without base, and is only placed on a plinth. For all the other orders, the Attic and Ionic bases are employed. The Attic base (*pl.* 19, *fig.* 22) is composed of a plinth, a torus, a scotia, a socle, and a second torus. The Ionic base (*pl.* 22, *fig.* 4) has a plinth, a scotia, and several dividing beads and fillets, a second scotia, a slab, and a torus.

The shaft, and the Doric and Ionic capitals have been described already. The Corinthian capital (*pl.* 19, *fig.* 13) is generally composed of two main parts. The first is the *calathus* or cup, whose ornaments present three different tiers: 1, eight acanthus leaves; 2, eight acanthus leaves with their stems (*caulicoli*); 3, four volutes with acanthus buds and leaves. The second main part of the capital is the abacus or top piece, whose mouldings are the wave and the erect bell. It has projecting, truncated corners, and its receding sides are ornamented with flowers. This refers, of course, only to the general type of the Corinthian capital, for its ornaments are infinitely varied.

The pillar (*pila*) differs from the column in its connexion with the wall, on account of which it has often been identified with it, though on the other hand, the pillar has many relations to the column, being often placed in the same row, for the same purpose of supporting the architrave or entablature. It receives similar decorations, particularly in the capital and base, sometimes even the reduction of size towards the top and the entasis. We distinguish the following kinds of pillars: 1. Pillars standing free on all sides. 2. Pillars which strengthen the corners of a wall (*antæ*). 3. Pillars which stand in place of door jambs (*postes*). 4. Pillars which project from the wall, either to mark the beginning of an adjoining colonnade, or merely to break the simplicity of the wall; these are termed pilasters (*parastates*). 5. Buttresses (*anterides*). 6. Short pillars, which serve as pedestals for columns (*stybolatæ*) (*pl.* 20, *figs.* 1–5).

The pillar is composed of a foot (*spira*), a shaft or cube (*truncus*), and of a capital (*metopon*), which is always somewhat lighter than the capital of the corresponding columns, with which its ornaments are generally in keeping.

The wall is the continuation of the pillar, and of course deviates still more from the characteristic features of the columns, because its object is not only to support, but also to inclose. Yet, like the pillar, it often receives a base and kind of capital, the cornice. Low walls occur partly as fences, in part as pedestals for the main walls, in which case they are called *ashlers*. Substructures of greater height and richer finish are termed *stereobates* or *stylobate*. They exhibit a distinct base, cube, and cornice (*pl.* 7, *fig.* 20, *b*).

Flights of steps are frequently introduced for the same purpose, to raise the building above the ground (*pl.* 20, *fig.* 8). If the steps are more than

twelve inches in height, substeps are introduced in order to afford easier access (*pl.* 15, *fig.* 1).

The trimmings and decorations of doors and windows in the walls correspond with the entablature of the different orders. Thus we have 1, Doric doors, whose jambs and lintels are *cymatium doricum*, and *astragalus* mouldings, whilst the cornice has in addition an *echinus* moulding with considerable projections. 2. Ionic doors, having jambs and lintels similar to the Ionic architrave, divided in stripes (*cordæ*), and trimmed with an astragalus moulding (*pl.* 20, *fig.* 14). The lintel is surmounted by a cornice (*hyperthyrum*) resting upon two consols, *ancones* or *parotydes.* 3. The Attic door, similar to the Doric, with the addition of the Ionic stripes. The windows are surrounded and decorated with similar trimmings, generally somewhat simpler.

The entablature connects the supporting parts of the building with those which cover the same, and consists of three parts: 1. The main beam or architrave (*epistylium*). The Doric architrave is smooth (*fig.* 8), surmounted by a fillet whose face is divided by triglyphs, which pierce a socle (*regula*), ending in drops (*guttæ*). The Ionic architrave (*pl.* 7, *fig.* 24) generally is composed of three stripes (*fasciæ*), surmounted by a cornice of mouldings. Sometimes its lower surface between the columns is decorated with deep pannels and other ornaments (*pl.* 19, *figs.* 27, 28). 2. The frieze (*zoë*), which connects the different beams resting upon the architrave. The Doric frieze (*pl.* 20, *fig.* 8) is composed of triglyphs, which represent the ends of the beams, being laid on every column, and over the columnar distances. The triglyphs exhibit three ridges, separated by two deep grooves, and bordered by two smaller ones, the whole surmounted by a small capital. The spaces between the triglyphs are termed panels (*metopes*), which are generally smooth, but sometimes ornamented with bas-reliefs. The Ionic and Corinthian friezes (*pl.* 7, *fig.* 24) are quite plain, and finished with wave mouldings. If they are decorated with metal or stone ornaments they are termed *zophorus.* 3. The cornice (corona) is composed of the projecting mouldings which form part of the roof. The Doric cornice (*pl.* 20, *fig.* 8) is formed by a Doric cyma, the corona projecting considerably, and containing the ends of the roofing boards (*mutuli*) with the heads of the nails, and is finished with a second cyma, and an erect bell moulding. The Ionic cornice (*pl.* 7, *fig.* 21) shows a fillet with dentals, sometimes also quite plain (*fig.* 24); above the dentals is a wave moulding, followed by the corona, which terminates in a slab and erect bell moulding. The Corinthian cornice (*pl.* 22, *fig.* 7) is similar to the Ionic, differing only in having small consols (*mutuli*) as bearers of the corona, which are composed of volutes and acanthus leaves. In all the different cornices great simplicity of decoration, and comparatively great height and projection, denote a great age of the monuments, whilst buildings of a later period show less projection, narrower surfaces, and frequently very elaborate decorations.

The plain ceiling, formed by a stone resting on the walls, occurs only in buildings of the very simplest description. The ceilings of temples and palaces were divided into deep panels (*lacunaria*), adopted from the archi-

tecture in wood, where they were often inlaid with gold and ivory. The wooden ceiling consisted of the beams resting upon the architrave, of the narrower and jointed cross beams, and of the caps covering the spaces between the cross beams. The same construction is imitated in stone, but in the latter material the different parts are usually wrought in one block.

The roofs of private dwellings were either flat, or pitched from the centre towards all sides, like a tent. Public buildings, particularly temples, had gables on the narrower sides of the building (*pl.* 7, *figs.* 21, front, 22, side view, 23, upper view in part). In Grecian buildings the height of the gable was about one eighth of the width of the building, in Roman buildings rather more. The gable or frontispiece (*fastigium*) is composed of the gable field, *tympanum* (*fig.* 21 A), which is frequently ornamented with statues and bas-reliefs, and of the cornice with the corona B, and the cyma C. The cornice of the gable is the continuation of the main cornice of the building, but is run up over the top of the gable, instead of being continued on a level with the long cornice, which would place it at the base of the gable field, in a straight line. The corners and the top of the gable are decorated with masks (*pl.* 19, *fig.* 38) or flowers, or with pedestals for statues, both at the top (*pl.* 7, *fig.* 21, E), and at the sides (*fig.* 7, D, D). The slope of the roof is covered with flat marble slabs (*figs.* 22, 23, H), whose long edges form projecting ridges. These are placed close together, and the joints covered with semi-cylinders of marble, clay, or bronze, whose lower extremities terminate in handsome front tiles, *antefixæ* (*pl.* 19, *figs.* 34–37). Similar ones are sometimes placed on the gable cornice. The water is conducted from the roof by small gutters piercing the cornice in different places, the outer openings being in some of the ornaments as in F (*pl.* 7, *figs.* 22, 23), whilst the others, G, remain solid.

Having thus examined the various component parts of buildings, we now proceed to notice the different classes of edifices. They are first divided into those erected for the effect of their exterior, and those built with a view to certain advantages to be derived from their interior. Of the former we may again distinguish two kinds, those that are monuments in themselves deriving aid from pictures or inscriptions, and those that serve as substructures for other more emblematic works of art.

The simplest monuments of the former kind belong to the period in which architecture and sculpture were still identical, and which is represented by the *hermæ* (*pl* 19, *figs.* 32, 33, the latter a terminal statue of Janus). Next in order are the tombs, frequently of chaste architectural forms, bearing inscriptions and bas-reliefs, and the horizontal tombstones. The second kind includes such single columns as were employed even in the most ancient Grecian temples, in order to give a prominence to the images, and the honorary columns which supported either the statues of distinguished men, or caldrons, tripods, &c.

Among the structures erected for the sake of the area they circumscribe belong inclosures of every description, walls of cities, castles, sacred grounds, and places of public meetings. The addition of a roof over the inclosure makes it a house.

The simplest house is the temple, at first only intended as a place for the safe keeping and protection of the image of the deity. The prominent character of the temple proper is the mysterious or awe-inspiring, and therefore it never had windows. The next thing was to give it a form, which would afford both protection and airiness, and for this purpose porticoes and colonnades were added. At a later period the centre portion of the roof over the inner temple was left open, which gave the interior a more roomy appearance. Formerly it had no other light than through the door.

According to their different modes of construction the following temples are distinguished with regard to various points.

1. With regard to the position of the columns; *a.* The temples in Antissa, with pillars under the corners of the gables, and columns between them (*pl.* 16, *fig.* 33); *b.* The *prostylos*, temples with a portico in front (*fig.* 27); *c.* The *amphiprostylos*, with a portico in front and rear (*fig.* 36); *d.* The *peripteros*, temples with a colonnade all round the building (*fig.* 26); *e.* The *pseudoperipteros*, temples with portico in front and rear, but half columns along the side walls (*pl.* 15, *fig.* 11); *f.* The *dipteros*, temples surrounded by two colonnades (*pl.* 12, *fig.* 4); *g.* The *pseudodipteros*, a temple with one colonnade round all the four sides, the distance between the columns and main walls twice the distance between the columns (*pl.* 12, *fig.* 8).

2. With regard to the number of columns in front. *a. Tetrastylos*, temples with four columns (*pl.* 16, *figs.* 36, 38); *b. Hexastylos*, with six columns (*pl.* 15, *fig.* 19); *c. Octastylos*, with eight columns (*pl.* 16, *fig.* 16); *d. Decastylos*, with ten columns (*pl.* 16, *figs.* 3, 14); *e. Dodecastylos*, with twelve columns (*pl.* 16, *fig.* 15).

3. With regard to the distance between the columns, as described before (p. 26).

There are also circular temples, among which we distinguish: *a.* The *monopteros*, whose columns are connected merely by railings (*pl.* 13, *fig.* 9); *b.* The *peripteros*, with a colonnade all round (*pl.* 16, *figs.* 9, 12); *c.* The *pseudoperipteros*, where the colonnade is only designated by half columns on the wall (*pl.* 9, *fig.* 5). Besides these there are circular and hexagonal temples with one or more halls (*pl.* 9, *fig.* 4; *pl.* 13, *fig.* 11).

The different parts of a temple are the substructure with the steps (*suggestus*), and the temple proper, sometimes twice repeated in the same building (*pl.* 16, *fig.* 3). The latter generally exhibits, *a.* The place for the statue, sometimes surrounded by a railing (*pl.* 12, *fig.* 2; *pl.* 16, *fig.* 14); *b.* The space which is left unroofed (*pl.* 11, *fig.* 3, where it is surrounded by the innermost columns); *c.* Colonnades in the interior of the temple somewhat elevated above the main floor, *stoæ* (*pl.* 15, *fig.* 2); *d.* The sanctuary (*adyton*), sometimes wanting (*pl.* 11, *fig.* 17, towards the rear); *e.* The fore hall (*pronaos*), the space between the front columns and the front wall (*pl.* 12, *fig.* 6); *f.* A similar space in the rear of the temple, *opisthodomos* (*fig.* 8); *g.* The colonnade, *pteroma* (*fig.* 11); *h.* Attached to colonnades or porticoes (*pl.* 10, *fig.* 9, *c*), occurring only seldom.

A numerous class of ancient buildings are the amphitheatres (*agones*),

open spaces surrounded by many gradually rising rows of seats. They were erected for the spectators at public games or combats. The theatres proper had the stage attached on one side of the circular area.

The odeons were erected for similar purposes with the theatres, but their stages were not so spacious, as only few persons acted on the same. The odeons had mostly permanent roofs, whilst the theatres were covered with large sun tents (*velaria*) as a protection against the sun and the dust.

The *stadia*, or racecourses, were of an elliptical form, and contained lists between which the horses ran, and a column (*meta*) marking the winning point. They were surrounded by an amphitheatre for the spectators. The *hippodromes* were similar structures arranged for chariot races.

The halls (*stoæ*) belong to the same class of buildings. They were erected for public meetings and business purposes, and were large inclosures protected against the sun and rain by a roof resting upon columns. Sometimes the columns were connected by walls, and had three or five parallel colonnades (naves), the lateral ones often having double tiers of columns, so as to form upper galleries; the front space was termed the chalcidicum; the rear, sometimes of a semicircular shape, the *tribunal*. These buildings were the prototypes of the Roman *basilica*.

The *gymnasia*, or *thermæ*, may also be classed here, the former being halls or inclosures for physical exercises, the latter for bathing purposes.

The tombs, or mausoleums, were erected with a view to the preservation of the body or the ashes of the departed, or as monuments in honor of their memory. The rock-cut tombs were almost exclusively intended for the former purpose, though sometimes a frontispiece invited public attention to the same. In Greece and her colonies in Lower Italy the chambers were usually wrought in the shape of a coffin (*sarcophagus*). The monumental tombs frequently also contained a chamber for the corpse of the deceased. The most appropriate form for the combination of the sepulchre and monuments is that of a pyramid or of a tower-like building. The idea of the terrace-like monuments was probably derived from the shape of the funeral pile. Honorary monuments were analogous structures, but without any reference to the reception of bodies. They were erected for the purpose of receiving an image or emblematic group either into a niche or under a roof resting on columns.

The triumphal arches combine in an ingenious manner the two objects of commemorating victories and of affording prominent places for the statues of the heroes.

2. *Special Description of Grecian Structures.*

1. Cyclopean Structures. Almost all the cities in Greece were originally built on mountains, the natural defence of which was increased by thick walls around the cities. In time the increase of population made it necessary to extend the cities beyond the wall, and they were gradually grouped round the foot of the mountain, which, with its fortified walls, became the citadel of the city, and was called Acropolis. It served also to preserve in safety

the most valuable property of the city, the treasure, the archives, &c.; and the temples of the tutelar deities were erected there for greater safety. Numerous ruins show that almost every city had its acropolis. The oldest of them are known as the Cyclopean or Pelasgian walls. The number of cities known to have had such walls is nearly 400.

The ruins of the acropolis of Tiryns are among the most gigantic works of the kind in ancient Greece. The city of Tiryns, at present Palæo-Anapli, was situated in Argolis, near Nauplia, in a valley called after the hill upon which the acropolis was located, whose walls are the only remaining fragments of the place, which according to historical sources was erected by Tiryns the son of Argos, 1740 B. C., and was destroyed by the Argives 468 B. C. and the inhabitants carried to Argos. According to Pausanias the walls were constructed of rough stones, of so large dimensions that the smallest of them could not be moved by a yoke of oxen. The acropolis (*pl.* 8, *fig.* 1, plan; *fig.* 2, view of the line *ab* in *fig.* 1) was situated upon a long rock not more than 30 feet high, and lying due south and north. The walls surround a space 200 feet in length, by 60 feet in width. They are from 19 to 22½ feet thick, built in straight lines, and their highest points are still upwards of 40 feet in height. The blocks are 10 to 13 feet long, by 4 feet thick, and are put in as they came from the quarry. The original height of the walls was probably 55 feet. Some blocks are found inside, which are more carefully trimmed than the rest; they probably formed part of the entrances, which, according to Gell, were three. The eastern one is still in tolerably good preservation, and has a tower 22 feet wide, and at present of the same height, whose walls are constructed in a similar manner. The gateway is 15½ feet high, the lintel about 10½ feet long. It is probable that it had a front ornament, as there are two stones lying near the gate, which together form a triangle; whether they have been sculptured cannot be ascertained, as the one is very much decayed, and the other lying with its face to the ground. The gate swung on centre pivots secured in the sill and lintel. Inside the wall are two galleries whose ceiling is formed by two rows of stone blocks leaning against each other at an angle of 45 degrees. These galleries have window-like openings, which probably communicated with some detached construction, of which remains are traceable near them. The ceiling of the galleries is undoubtedly the oldest specimen of such a construction as yet discovered in Greece, and probably the first rude attempt at the arch.

Vast ruins of Cyclopean monuments are also found in the acropolis of Mycenæ, at present Karvati, in the Morea, erected about 1700 B. C. It formed an irregular triangle along the outlines of a hill. The walls are not all constructed in the same manner, nor probably at the same time. Some parts are built of rectangular blocks, the joints of several courses placed in perpendicular lines above each other; other parts of irregularly polygonal blocks; and again others, particularly those parts near the entrances, of regular blocks in good binding. The acropolis had three entrances. The first and smallest was formed by two immense stone blocks leaning against each other. The second and larger one was constructed of two upright massive jambs,

supporting a huge block as a lintel. The third was the renowned Gate of the Lions (*pl.* 8, *fig.* 5, front elevation; *fig.* 6, section through the middle of the gateway), which formed the main entrance to the city. The door jambs are about 16 feet high, and the width under the lintel is about 9½ feet; the lintel itself is one block 14 feet long, 6 feet high, and 4 feet wide. Over the entrance is a bas-relief sculptured on one triangular block 10 feet long, 9 feet high, 5½ feet thick, of very hard, fine-grained, grey limestone. It represents a half round column, shaped somewhat like the Doric, but thinner below than above, and with a capital upon which are placed four rounded bodies, apparently supporting a second abacus. On either side of the column are erect beasts, considered to be lions, though the tails are unlike those of lions, and the heads are wanting. The emblematic import of this bas-relief has not yet been determined. Similar allegories are found in Persian sculptures and coins, where the column appears to be the altar of the sacred fire, attended either by men or lions. The lion was the symbol of the god Mithras, and his priests were termed lions. As there undoubtedly existed a lively intercourse between the Persians and Spartans, and as the latter in remote times worshipped the sun, or its symbol the fire, it may with some probability be supposed that the four rounded bodies on the column were intended to represent the ends of logs, and the supposed second abacus the side view of another log, thus indicating a sacrificatory fire, whose flame must have been destroyed with the heads of the lions. The whole would thus have represented the altar of the deity of the sun, which was worshipped at Mycenæ. The Gate of the Lions probably dates from the time when the city was rebuilt by Perseus (1400 B. C.), and the bas-relief is the oldest known ornament of Grecian sculpture, dating from the heroic age before the Trojan war.

The treasury buildings deserve especial mention in this place, as we first meet with them in Greece. They served to receive either the public treasure, or the wealth of a prince, or the sacred vessels of a temple. Agamedes and Trophonius erected such a building for king Hyrieus at Orchomenus, where the treasury of Minyas was also located. That of Atreus in Mycenæ is however the most remarkable (*pl.* 8, *fig.* 7, view of the entrance, *fig.* 8, section of the building). The chamber for the treasure is cut in the rock, and has a fore-hall of circular form executed in bound masonry, and arched like a bee-hive, which is entered by a long passage between two cyclopean walls. Its location is not far from the acropolis, surrounded by ruins of different buildings, with circular ground-plans and parabolically arched ceilings. The passage to it is about 19 feet wide and 59 feet long; the entrance 8 feet in width at the top, and 10 feet at the bottom, by 20 feet in height. The entrance is built of regularly cut stone blocks from a breccia quarry in the neighborhood. The most remarkable part of the entrance is the lintel, which is formed by two huge blocks, the lower of which is 25 feet long, 20 feet wide, and 4 feet thick, and extends within the arch. The second block, almost completely covered with earth, is probably of the same dimensions. Blocks as large as these have never been found in the walls of buildings, except in the ruins of Baalbek. Over the lintel there is a triangular opening, which

may once have contained a bas-relief similar to that of the Gate of the Lions, or perhaps was only introduced for the sake of ventilation, and with the intention to relieve the pressure on the lintel. The construction of the circular room is remarkable, consisting of many horizontal rows of stones placed above each other, in circles of gradually reduced diameters, whilst their inner surfaces are smoothed off to form a parabolic line (*pl.* 8, *fig.* 8). The diameter of the floor is 48 feet, the height 37 feet, 2 inches. The walls have probably been decorated with bronze panels, as there are numerous bronze nails among the rubbish, and here and there holes drilled in the walls, and in the joints between the stones. The rock-cut chamber is at the right hand side from the entrance; it is rectangular, 27 feet, 10 inches long, 23 feet, 6 inches wide, and a little over 12 feet high. Some fragments of marble ornaments found in the passage which leads to the main building have induced some persons to suppose them the decorations of the entrance door, and Donaldson has tried to put them together and restore them; but the style of these ornaments proves beyond doubt that they belong to a more recent period than the exquisite simplicity of style of the building itself. They therefore probably formed part of some other building in ancient Mycenæ.

To the period of Pelasgian and Cyclopean structures belongs also a temple on the island of Gozzo, known as the *Giganteja*, or the tower of the giants. It was first described in 1836 by Count de la Marmora, and is one of the most important structures of the numerous ones wrought by the Phœnicians when they introduced their religion into Greece, Sardinia, Malta, Spain, and the Balearic Islands. We have illustrated it on *pl.* 8, where *fig.* 10 represents the ground plan, *fig.* 9 a section corresponding to the line F C in *fig.* 10, and *fig.* 11 a section corresponding to the line HI in *fig.* 10.

The two temples, *fig.* 10, A and B, are surrounded by an immense wall constructed of irregular blocks of stone, partly upright, in part horizontal. Each temple is formed by five somewhat irregular semicircles opening in a centre nave; both have only one elevation with the entrances E and D. The inside walls, as well as the floors, were covered with stone slabs, some of which are still in their places at E. Similar flagstones of elliptical shape are lying in front of the entrance C, at F. The depth of the larger temple, FG, is 78 feet, its greatest width, HI, 70 feet, and in KL, it is 49 feet wide. In the first hall of the temple, on the right hand side of the entrance, stand several upright stone blocks, which surround the sanctuary, to which a few steps lead, the first of which is semicircular, and has had a railing, of which traces are left. Between the two steps at *a*, is a vacant space which was occupied by the sacred threshold, which must not be trodden upon. The background of this hall is covered with large stone plates. Here ascends the sanctuary, *b*, composed of upright stones, surmounted by horizontal stone slabs, and containing in the centre a conical stone, the symbol of Venus of Paphos, to whom the temple was consecrated. The corner stone is intended to represent the creative power, Phallus, or Lingam of the Indians. The division of this hall at K, opposite the former, contains the ruins of a very

large altar, behind which is the reservoir intended for the sacred ablutions, particularly the washing of the feet.

The second or main hall is separated from the first by a passage lined with stone slabs. It is one step above the former, and the floor is entirely covered with stone slabs. The right hand side of the hall at I, is shut off by a breast-work containing the altar, *d*, near which a few low stone slabs, *e*, are placed upright, in such a position as to suggest their having supported a table top. Behind these stones the holes *f f* are cut out in the walls, which even at present retain the marks of fire. They were probably the places where the small sacred cakes were baked. At *h*, is a small reservoir, probably for the water with which the dough was prepared; and near it a long stone, with the form of a fish wrought on it. The opposite side of the hall at II, contains the sanctuary, *g*, partitioned off by large upright stones with tables between them. The background is lined with small cells, which, according to the stamp of a coin of the times of Antoninus, representing similar cells in the temple of Venus, must have served as nestling places for sacred doves.

The posterior portion of the hall, at G, is the most elevated, and contains nothing but a few fragments of stone. This was probably the location of the statues of the goddess Astarte of the Phœnicians, the prototype of the Grecian Venus Urania, to whom the temple was consecrated.

The second smaller temple, B, is of similar form with the large one, but destitute of any kind of exterior finish, except the altar at M, of a single stone. At *k* is a pile of bones and broken pottery, from which it may be inferred that the remains of the victims were deposited in this part of the temple, which is separated from the rest of the temple by the wall, *l*. Neither of these temples appears ever to have had a roof, and they agree in this respect with the temple of Venus at Paphos, and all other temples where the religious rites bore any relation to Sabæism. But there are in many places holes in the stones in which perhaps masts were placed to support a suntent, the regulating strings of which may have been fastened in other holes near by.

The *necropolis* (city of sepulchres) of the ancient Etruscan city of Tarquinii deserves to be mentiond here, as its construction took place in the Cyclopean period. The subterranean chambers in the neighborhood of Corneto are the only remains of this place which we have mentioned in the historical part of this work, giving a view of it in Plates, Division IV. *pl.* 11, *fig.* 1. It was situated on a hill, and the sepulchres were marked by circular structures above-ground supporting a conical mound of earth. The interior of the sepulchres was frequently decorated with sculptures and paintings. Several of these chambers are in good preservation, and are known as the grottoes of Corneto (*pl.* 8, *figs.* 3, 4).

2. Temples and different other Buildings. The increased civilization and wealth of the Greeks, together with the abundance of superior materials, and the assistance of Phœnician and Egyptian mechanics and artists, at an early period induced them to construct the buildings erected in honor of their tutelary deities exclusively of stone.

The oldest Grecian temples were built in the Doric order. In our description of the Grecian monuments we shall follow the reports of Pausanias, whose annotations were made on a journey undertaken for the special purpose of examining works of art (A. D. 174), at a period when Athens was still in its full splendor. A view of its probable features at that time is given in *pl.* 9, *fig.* 1, where A A represents the acropolis (with *a* the Parthenon, or the temple of Pallas Athene, *b*, the statue of Pallas Athene, *c*, the temple of Erechtheus, *d*, the própylæa); B, the Museum with the monument of Philopappus; C, the Areopagus; D, the Pnyx; E, the theatre of Bacchus; F, the Prytaneum; G, the Odeon; H, the temple of Jupiter Olympius; I, the tower of Andronicus Cyrrhestes, or the tower of the winds; K, the temple of Theseus; L, the road to the Pyræus.

The Pyræus was the port of Athens. Its entrance was ornamented with two lions, and it contained five public halls, a large market surrounded by colonnades, several temples, and a theatre. The road to Athens lay between two enormous walls, running all the way from the city to the port, a distance of five miles.

Entering the city from this road, the first building near the gate was the Pompejon, the starting point of the religious processions. Near this edifice was an equestrian statue by Praxiteles. At a short distance from the Pompejon stood the temple of Ceres, which contained the statues of Proserpine, Ceres, and of the youthful Bacchus. Two colonnades led from the Pompejon to the part of the city called Ceramicus. There were several similar colonnades in Athens which were necessary for public places of resort. Near one of the colonnades at the Pompejon were several temples, the gymnasium of Mercury, and the house of Polytion, surrounded by an inclosure, where the Eleusinian mysteries were practised by several of the wealthy citizens of Athens. Next stood a small building which contained bas-reliefs of burnt clay, among which was prominent the festival of the Athenian king Amphyction. On the right hand side, near the end of the colonnade, in the district of Ceramicus, was the Royal Basilica, where the second archon of Athens held his court of justice, and where the Areopagus sometimes met. The name Basilica is derived from *basileus*, the king. This building was a peripteros, with porticoes in front and in the rear. The bas-reliefs in the gable represent the victory of Theseus over the pirate Skyron, and the rape of Cephalus by Aurora. At the entrance of the hall stood the bronze statue of Pindar, with a tiara around his head, a book on his knees, and a lyre in his hand.

Not far from the Royal Basilica were two remarkable buildings, to the right the temple of Apollo containing a picture of Apollo by Euphranor, and two statues of Apollo by Leochares and Calamis; and to the left the hall of Jupiter was situated, probably built with three rows of columns and walls placed inside the two outer rows of columns.

In the same district was the temple of Cybele, with a statue of the goddess by Phidias, and the House of the 500 Senators, with numerous statues and paintings. The square to the right near the Royal Basilica was surrounded by terminal statues with inscriptions at their base, containing either com-

memorations of great and gallant deeds of the Greeks, or admonitions to wisdom and virtue.

Next to the House of the Senate stood the Tholus, a circular building surrounded by plantain trees, in which the officiating magistrates took their meals, and offered the regulated sacrifices. Among different others it contained the silver statues of Cecrops and of Pandion, in front of which the first archon held his court of justice. After the Tholus came the temple of Ares (Mars), with the statues of Mars, Pallas Athene, Venus by Alcamenes, another Venus by Locrus, and others. The street leading from the Tholus to the market terminated in a hall lined with terminal statues, formed by several porticoes, and known as the Hall of the Hermæ. The inscriptions on the statues proclaimed the gratitude of the state towards the common soldiers.

In the rear of the Tholus was the Pnyx, where the large assemblies were held. Near it was the *Enneacrounos* or fountain with nine jets, the only public fountain of Athens; and beyond it, the temples of Ceres and Proserpine, and of Triptolemus, the deified founder of the Eleusinian mysteries. The former contained the statue of Ceres, and the latter that of Epimenides. Near the Eleusinium was the temple of Eucleia, or the Temple of Glory, erected with the booty made in the battle of Marathon, and containing a statue of Venus in Parian marble by Phidias.

Opposite the House of the Senate, in the market and adjoining the Royal Basilica, was the temple of Vulcan, containing statues of Vulcan and of Pallas Athene. Near to the Hall of the Hermæ was the Stoic Hall, in which philosophy was taught. In front of its portico were the bronze statues of Solon and Seleucus, and that of Mercury ornamented the entrance. The interior was decorated with paintings representing battles, the combats of the Amazons, &c. The north side of the market was occupied by the temple of Venus Urania and that of Æacus. On the market square itself was the altar of friendship, and a few other monuments of little importance.

North of the temple of Æacus was the temple of Theseus, the ruins of which still remain in tolerably good condition, whilst the location of the other monuments previously mentioned, with the exception of the Pnyx, can only be conjectured from literary sources. The Temple of Theseus as it is at present, is represented in *pl.* 9, *fig.* 3, whilst *pl.* 10, *figs.* 3 and 4, give views of its restored front, the latter for the sake of comparison reduced to the scale of the other elevations on this plate; and *pl.* 10, *fig.* 5, shows the plan. This Doric temple has columns all round, six in front, and thirteen on each side, the corner columns being counted twice, which is always done in giving the number of columns of different sides, as they appear on two. The temple is 104 feet long by 45 feet wide. The pronaos and posticum are formed by the extension of the side walls, and two columns stand between the corner pillars. The entire temple is built of white marble, the foundation of large blocks of limestone. The gable of the pronaos has been decorated with sculptures which have disappeared, but the frieze inside the pronaos still contains representations of several groups of combatants and spectators; and the frieze in the posticum the combat of Theseus and the

Lapithæ. The ten metopes of the front portico show ten labors of Hercules, and the four adjoining ones on either side, the labors of Theseus. The temple proper is 54 feet long, by 19 feet, 2 inches wide. The temple was erected ten years after the battle of Salamis, after the son of Miltiades had collected the bones of Theseus on the island of Scyros, and had triumphantly carried them to Athens. At present the temple of Theseus is used as a church of St. George, for which reason probably it is so well kept.

Not far from the temple of Theseus, opposite the Stoic Hall, was the gymnasium, erected by order of Ptolemæus, and containing the statues of Juba and Chrysippus, and a spacious court-yard surrounded with colonnades. Opposite the gymnasium, in rear of the Stoic Hall, was the temple of the Dioscuri, the entrance of which was decorated with the statues of Castor and Pollux, whilst on each side were those of their sons with their horses. The interior was decorated with paintings by Polygnotus and Micon, representing the wedding of the sons of the Dioscuri with the daughters of Leucippus and the embarkation of Jason and his heroes for Colchis.

Near this temple was the district consecrated to Aglauros, with a temple of this nymph. Then came the Prytaneum, where the written laws of Solon were preserved, and citizens who had distinguished themselves in the service of the state were entertained at public expense. It contained the statues of Vesta, of Peace, as well as of Miltiades, Themistocles, and other celebrated men. Opposite these different buildings were the portico of Hadrian, the vegetable market surrounded by a wall and double porticoes, and in the rear of the latter the Tower of the Winds (*pl.* 9, *fig.* 4, plan and elevation; *pl.* 19, *fig.* 9, capital from the portico).

The Tower of the Winds is an eight-sided marble building, whose faces are turned exactly towards the octants of the heavens, each containing a bas-relief allegory of one of the eight winds known to the Greeks. The tower carries a conical roof, on the top of which stood a bronze Triton serving as a vane. Below the bas-reliefs are as many sundials calculated to suit the corresponding points of the compass, which are considered by Delambre to be the most remarkable remains of the practical gnomonics of the ancients. The building originally had two entrances, one towards the north-east and the other towards the north-west, each of them ornamented with a portico of two columns. Stuart, when first surveying the building, after removing all the rubbish, discovered on the floor traces of a *clepsydra*, or water-clock, as described by Vitruvius, which was probably fed by a brook passing close to the tower, and which to this day is called Clepsydra. The water reservoir is located in the round house attached to the main building. The interior of the tower is divided into four different stories, which probably had floors for the door to rest upon. The decorations of the interior are of the Doric order; those of the exterior of the Corinthian.

Towards the south-east of the street of the Tripods, which began at the Prytaneum, are the ruins of the arch of Hadrian, forming one corner of a peribolus supposed by some archæologists to be portions of the temple of Jupiter Olympius, whilst others take them for the Pantheon of Hadrian. Of the temple of Jupiter Olympius, *pl.* 12, *fig.* 2, gives the plan; *fig.* 3, the elevation;

and *pl.* 11, *fig.* 4, the section, drawn according to the designs of the celebrated architect, Luigi Canina. The temple was a *dipteros dekastylos* of the Corinthian order, with twenty columns. The interior contained two tiers of columns, one above the other, and was a *hypæthros*, for the roof was open above the statue of Jupiter. Besides the porticoes, the temple had a pronaos formed by four Corinthian columns. The building was erected and the statues of gold and ivory put up by Hadrian. The pronaos contained four statues of Hadrian, and the peribolus, 2300 feet in circumference, was ornamented with statues which had been supplied by different cities, each contributing one. Another temple of Jupiter Olympius, of the Doric order, had formerly occupied the same spot, whose columns, after its destruction, were carried to Rome by Sylla, and erected in the temple of Jupiter Capitolinus, which was destroyed by fire. For the new temple Hadrian ordered the Roman architect Cossutius to adopt the Corinthian order, which was not generally introduced into Greece before the year 395 B. C. Of the 112 columns 16 are still standing. The length of the temple on the upper stair was 354 feet, by 141 feet in width. The columns had 6½ feet diameter, and were over 60 feet high; and like the rest of the building, were of Pentelican marble.

Towards the north-east of this temple were the statue of the Pythian Apollo, and a temple of the Delphian Apollo. East of the Olympæon, a gate in the city wall led to the district of the gardens watered by the Ilissus, on the left bank of which was the temple of Boreas. North-east of the latter, near the spring of Callirhoë, was a small Ionic temple, which some suppose to be that of Diana Agrotera, whilst others think it to be that of Ceres or of Triptolemus. It is represented on *pl.* 16, *fig.* 36, plan, and *pl.* 10, *fig.* 15, elevation. A few ruins of it still exist. It belongs to the Ionic order, but its proportions, notwithstanding their beauty, deviate considerably from those usually met with. The temple was an *amphiprostylos tetrastylos*, and built of Pentelican marble.

The Stadium of Herodes Atticus, built of marble, was also located on the left bank of the Ilissus, as well as a small temple of Hercules; and a little more to the east a temple of Venus, with a statue of the goddess. Opposite the latter, on the right bank of the Ilissus, was the Lyceum, containing large places for exercise, with 100 columns from Lybia.

The most remarkable of the monuments in the street of tripods is the choragian monument of Lysicrates, sometimes called the Lantern of Demosthenes. This is one of the most graceful of ancient architectural monuments. Its elevation is represented on *pl.* 9, *fig.* 5, whilst details are given on *pl.* 19, viz. a capital (*fig.* 10), a base (*fig.* 18), and the restored dome with the celebrated three-cornered flower that supported the tripod (*fig.* 24). This building, far famed in architectural history, is but 13 feet, 11 inches high, and has not more than 5 feet, 4 inches inside diameter. It was constructed as follows: Six marble slabs of equal size were placed close together to form a hollow cylinder. Along the upright joints semicircular cavities were wrought, just wide enough to receive Corinthian columns which were placed in them with great accuracy, one half projecting beyond the surface of the

cylinder; an entablature and a dome to cover it completed the building. Between the capitals of the columns are tripods in bas-relief, and the frieze is ornamented with a bas-relief representing the history of Bacchus, who conquered the Tyrrhenian pirates, and changed them into dolphins. The flutes of the columns terminate in leaves, an arrangement entirely unique. The recess at the neck of the columns has probably been filled by an astragalus of bronze or gold. The roof is of one single block of marble, admirably wrought so as to appear covered with tiles of the shape of olive leaves. The crowning flower is of a beautiful model, and terminates in three volutes of great elegance. Other volutes on the roof have probably served to carry some ornaments on which the corners of the large flower must have rested. In our restoration (*pl.* 19, *fig.* 24) we have adopted dolphins, to correspond with the frieze; others have introduced satyrs.

Behind this monument was the Odeon of Pericles (*pl.* 17, *fig.* 1, elevation; *fig.* 2, section; *fig.* 3, plan). It was of the Doric order, circular, with 32 stone columns supporting the peribolus. The masts of the Persian ships taken in war were used as rafters in the roof, which had the form of a tent. According to Diodorus, the building was of an oval shape, with an open portico (*pl.* 10, *fig.* 10, front; *fig.* 11, side view; *fig.* 12, plan). During the Mithridatian war it was either destroyed by fire or pulled down by the order of Aristion, the Mithridatian commander, to facilitate the approach to the Acropolis. It was rebuilt, by the order of Ariobarzanes, by Caius and Marius, sons of Caius Stallius. On certain days the Odeon was used as a grain market.

The Theatre of Bacchus, located at the southeastern foot of the Acropolis, stood so near to the latter that the seats were partly cut in the rocks. This theatre was built by Themistocles, and afterwards the interior was decorated with portraits and statues of different poets. In the rock of the Acropolis, at the height of the top of the roof of the theatre, was the choragian monument of Thrasyllus and Thrassicles cut out in shape of a niche or a grotto, and adjoining it another niche containing a tripod, upon which were represented Apollo and Diana murdering the children of Niobe. Adjoining the theatre was the temple of Bacchus Limnæus, the oldest temple of this god at Athens. Its peribolus inclosed still another temple, that of Bacchus Eleutheros, whose statue was of gold and ivory.

On the southern slope of the rock of the Acropolis were the mausoleum of Talus, who was killed by Dædalus, and the temple of Æsculapius, containing the statues of Æsculapius and of his children, besides several beautiful paintings.

The Odeon of Regilla, located at the southern foot of the rock of the Acropolis, was built 150 years B.C., by Herodes Atticus, in honor of his wife Regilla. Eumenicus added a colonnade to it, which connected it with the theatre of Bacchus. It was of white marble.

South of the Stoic Hall, and southeast of the Pnyx, were the Areopagus and the temple of the Eumenides, situated upon a hill commanding the view of the seashore over the roof of the Pnyx. Near this place is a Doric portico (*pl.* 10, *fig.* 13, elevation; *fig.* 14, plan) supposed to have been the entrance

of the Agora or vegetable market, from an inscription on the same mentioning the names of two superintendents of the market, and another containing a proclamation of Hadrian regulating the sale of oil and the duties to be levied on importations.

After having thus mentioned the various buildings alluded to by ancient writers as being in the city of Athens itself, we now proceed to the edifices on the Acropolis, the citadel of Athens, among which we find the best preserved monuments of Grecian antiquity; whilst those in the city proper have been entirely destroyed, with the exception of the few whose ruins we have noticed more in detail.

The Acropolis of Athens (*pl.* 11, *fig.* 1), according to historical traditions, was planned and executed by the Pelasgians, who were masters in the art and science of fortification in ancient times. It was a citadel which by strong walls was well secured against any hostile attack, and inclosed a sacred place filled with a number of temples and adorned with the noblest and most exquisite productions of art. It was, in fact, the sanctuary of Athens, where the Panathenæan festivals were celebrated, and the depository of the public archives and the state treasure.

Pausanias, the best author on Athens, has left us descriptions of all the luxury and beauty condensed upon comparatively so small a spot, which are indeed astonishing. He mentions the temples of Diana, of Venus, of Minerva Polias, of Erechtheus and Nike Apteros, and of the Parthenon. Of all these glorious structures nothing has been preserved but the ruins of the propylæa of the Parthenon, of the temples of Minerva Polias and Erechtheus, and the Hall of the Nymph Pandrosos; but they suffice to bear evidence to the grandeur and beauty of the monuments in the time of their glory. Large flights of steps on the western slope of the mountain, ornamented with two equestrian statues upon pedestals, led to the main entrance of the citadel, which was built in the purest style of the Doric order, and is far-famed under the name of the Propylæa. This magnificent structure, undoubtedly one of the most characteristic monuments of the time when Athens was in her prime, was commenced 437 B. C., and completed in the exceedingly short time of five years, according to the designs and under the superintendence of Mnesicles.

Pl. 11, *fig.* 1, shows a perspective view of the edifice, which is composed of the main or centre building, with projecting wings, forming three sides of a quadrangle. The centre building, with its six columns, offers five entrances to the interior of the Acropolis. The side building to the right forms a portico to the Doric temple of Nike Apteros (the wingless Victory), of which *pl.* 16, *fig.* 32, gives the plan, whilst *pl.* 11, *fig.* 1, has a view of it near the right hand pedestal. The left side building contained in one of the interior apartments the famous paintings of Polygnotus. The portico in the rear, facing the interior of the Acropolis, was similar to that in front, both of them being of the Doric order, whilst the vestibule has Ionic columns, but without a base. Only very recently the discovery of a very carefully constructed inclined plane leading to the Acropolis has decided the question whether chariots had entered it, which had been supposed on account of the

greater distance between the two centre columns, and on the strength of the representations of chariots in the bas-reliefs of the Panathenæan games on the frieze. The marble beams which formed the ceiling were 17 to 18 feet long, and of sufficient thickness to receive deep panels, which were ornamented and painted. The depth of the building from the front to the rear wall was 43 feet, to which the posticum, of 18 feet in depth, was attached. The wings, or side buildings, had temple fronts of three columns between pillars, and were constructed, like the main building, of Pentelican marble. The columns of the propylæum are 27 feet high; those of the side buildings are 18 feet high by 3 feet in diameter.

The Parthenon, dedicated to Pallas Athene, was one of the largest and most magnificent temples in Greece, for the illustration of which we refer to *pl.* 9, *fig.* 2, western front; *pl.* 10, *fig.* 6, eastern front; and *pl.* 11, *fig.* 6, longitudinal section. It was in excellent preservation as late as the year 1676, when it was visited by Wheler and Spoon, but in the following year, when the Venetians bombarded Athens, a shell penetrated to the ammunition of the Turks, kept in the temple, and the explosion that followed did great damage to the edifice. The sculptures of the gable and frieze have been taken away by the English, and are now in the collections of the British Museum.

The temple is a peripteros with 8 columns in front and 17 at the sides, and a hypæthros with its interior columns in double tiers. The porticoes had two rows of columns each. The temple was built by Ictinos and Callicrates (470 B.C.), and is 227 feet 7 inches in length, by a width of 101 feet 1 inch. It presented the peculiarity that the usual corner pillars of the second row of columns in the porticoes are substituted by columns. The outer columns are 35 feet, 5 inches high, by 6 feet, 1 inch in diameter; those on the corners are 2 inches thicker.

In ancient times the Parthenon was called Hecatompedon, because it had exactly 100 feet front, according to Roman measure. The width of the *cella* in the rear was 62½ feet by a length of 98 feet 7 inches; the length of the vestibule was 43 feet 10 inches, and the total height of the temple 65 feet. The cella contained a magnificent statue of Minerva by Phidias, made of the costliest materials, chiefly gold and ivory. The two gable fields were also richly adorned with sculptures, which, as late as 1683, were in tolerably good preservation, when the French ambassador at the Porte, Nointel, caused them to be drawn accurately by a Dutch artist, whose drawings have been consulted in the various attempts made at restoring the groups in recent times. The groups in the western gable fields had reference to the birth of Pallas Athene, whilst those of the eastern represented her contest with Neptune about the sway of the land. The panels in the external Doric entablature contained 92 bas-reliefs representing the wars of the Lapithæ and the Centaurs, and the frieze around the cella and vestibule, which was upwards of 500 feet in length, bore sculptures representing the Panathenæan games.

Another remarkable group on the platform of the Acropolis is formed by the temples of Minerva Polias and Erechtheus, and the hall of the nymph Pandrosos. *Pl.* 10, *fig.* 8, gives a view, and *fig.* 9 the plan of this group,

whilst *pl.* 11, *fig.* 5, is an attempt at a restoration of the same. For details we refer to *pl.* 7, *fig.* 24, the columnar order; *pl.* 19, *fig.* 6 *a*, capital from the portico of the temple of Minerva Polias; *fig.* 6 *b*, capital from the portico of the temple of Erechtheus; *fig.* 17, base from the former; *fig.* 18, base from the latter; *fig.* 31, caryatide from the hall of the nymph Pandrosos.

This group was erected during the Peloponnesian war, probably 409 B. C., but took fire only three years later. Its eastern side is formed by the temple of Erechtheus, with a portico of 6 columns, 21 feet, 8 inches high, fluted, and with decorated necks. The portico leads into the cella (*pl.* 10, *fig.* 9 *b*), which is 70 feet 6 inches in length by 32 feet 4 inches in width. It contained the salt spring, and the altars of Neptune, Vulcan, and the hero Butes. The rear of this curious group was formed by the temple of Minerva Polias, whose cella is at *a* (*fig.* 9). Its portico has 4 columns 24 feet high, facing north. In the rear of the cella is the hall of the nymph Pandrosos (*fig.* 9 *c*), which, in place of columns, had 6 beautiful caryatides supporting the entablature, one of which was carried off by Lord Elgin. It has been replaced by a pillar of bricks bearing the stigmatizing inscription: "This is the work of Lord Elgin." The capitals of the four columns forming the portico are larger, more richly ornamented, better executed, and altogether in a superior style to the other capitals of the group. The columns have a considerable swelling. Behind this portico a beautiful doorway with consols and entablature has been dug up, all of white marble.

The interior of the Erechtheum was also decorated with sculptures and paintings. Near the entrance stood the three altars which we have mentioned, and which were highly finished works of art. The walls were adorned with pictures. The division of the group consecrated to Minerva Polias contained a wooden statue of Mercury, an offering of Cecrops; a folding chair, wrought by Dædalus and offered to the gods as a useful invention; the sword of Mardonius, suspended on the wall; and the statue of Minerva, in front of which was the eternal lamp, an offering of Callimachus, the alleged inventor of the Corinthian capital.

Besides the afore-mentioned monuments in the city and upon the Acropolis, there are the ruins of the aqueduct of Hadrian, consisting of a few columns and one arch at the foot of the mount Anchesmus; the tombs of Thrasybulus who overthrew the government of the thirty tyrants, of Pericles, Chabrias, Phormion, Harmodius, Aristogiton, and of many combatants at Marathon.

A large road called the Sacred Way, about 500 stadia long, led to the city of Eleusis. On both sides of this road so large a number of tombs, mausoleums, and columns had been erected during the flourishing time of Greece, that Polemon wrote an extensive work on them. At present, the site of the road even is not perfectly known, and no traces whatever are left of the palace of Crocon, or of the temple with the statues of Apollo, Ceres, and Minerva. Eleusis at present contains the ruins of four buildings, viz. the propylæa, the temple of Diana, the mystic portico, and the temple of Ceres. The propylæa formed part of the peribolus which surrounded the temples, to which only the initiated were admitted, a regu-

lation particularly enforced at the temple of Ceres. They form a portico of six Doric columns of 5 feet and half an inch in diameter, which leads to the vestibule of six Ionic columns in two rows, which is followed by four pillars standing free, and inside by six Doric columns. The front gable field was decorated with a priest's head surrounded by a ring.

The temple of Diana Propylæa (*pl.* 10, *fig.* 16, elevation; *pl.* 16, *fig.* 35, plan) is accessible by six steps, the uppermost of which is 69 feet, 8 inches long. The temple is of the Doric order, with corner pillars and two columns of 2 feet, 7 inches diameter. The stone blocks of the ceiling, like the rest of the building of white marble, are 83 feet long by 3 feet wide, and 2 feet, 6 inches thick, each of them weighing about 11 tons. The cornice and gable tops had front tiles. The building is very much dilapidated.

The Mystic Portico, where those about to be initiated in the Eleusinian mysteries had to undergo certain ceremonies, is of the Ionic order, and contains near the door two pilasters, with Corinthian capitals of uncommon beauty. This hall formed the vestibule of the temple of Ceres and Proserpine, one of the most remarkable ancient buildings, which, however, was totally destroyed by Alaric. The temple had a portico of twelve Doric mantled columns of 6½ feet in diameter. The fore hall is 38 feet deep, the corner pillars projecting so far as to indicate the existence of a second row of ten columns. The temple was a prostylos, and according to Vitruvius the fore hall only was added to the main building by Demetrius Phalereus, whilst the latter was built by Ictinus, 439 B. C.

All the monuments at Megara and Corinth, to which Pausanias even alludes as being much injured by time, are totally destroyed. On the isle of Ægina, which at an early period was considerably advanced in civilization, many once celebrated monuments had already disappeared at the time of Pausanias. The most splendid building on the island at that time was the temple of Jupiter Panhellenius, some of the ruins of which are still existing. The ground-plan of this temple (*pl.* 13, *fig.* 12) shows that it had been a peripteros of six columns in front, and twelve at the sides. It was of the Doric order, hypæthral in construction, and with two rows of columns in the interior. The gable field was decorated with sculptures which have been carried to Munich. The proportions of this monument are excellent, and the mouldings of the capitals and the entablature of a bolder character than those of the temples of Minerva and Theseus at Athens.

Two Doric columns of the temple of Venus, situated near the harbor, are all that remains of a number of other temples formerly known on Ægina. The Ægina theatre was considered to be of a very superior style, and was of larger dimensions than that at Epidaurus.

Argos, a city in the district of Argolis, was the residence of the famous sculptors Polycletus, Praxiteles, and others, who by the master-pieces of their art ornamented its temples, among which were those of Jupiter Soter, Juno, Bacchus, Apollo Lycius, and Venus; and the temple of Minerva located upon the acropolis, which also contained a treasury of Atreus similar to that at Mycenæ. All these buildings, together with a large number of magnificent tombs, are entirely destroyed, a few columns of the Doric order

and of rather slender proportions of the temple of Jupiter Nemæus, between Argos and Corinth, being the only traces left of them. Of this temple, *pl.* 16, *fig.* 17, and *pl.* 13, *fig.* 13, show the plan, the latter figure with the omission of the three columns between the corner pillars of the pronaos. A few other ruins near Argos are supposed to be those of a theatre, of the palace of Agamemnon, and of an aqueduct. About four miles from Argos near Mount Euboia was the temple of Juno, famous for its beautiful sculptures, those in the gable fields being representations of the birth of Jupiter, the war of the gods and the giants, and the Trojan war. The statue of Juno in the temple was of gold and ivory.

At Bassæ, near Phigalia, was the temple of Apollo Epicureus, one of the most remarkable monuments of Greece, and especially of the Peloponnesus. This temple, built by Ictinus in the time of Phidias, was 125 feet long, by 47 feet wide, with six Doric columns of 3 feet, 7 inches diameter, and 19 feet, 6 inches high in front, and of 13 columns of the same size on the sides (*pl.* 11, *fig.* 10, ground plan). The interior of the cella contained ten Ionic columns in two rows, with capitals remarkable on account of the volutes being placed diagonally, and therefore presenting four equal faces, instead of the usual two. Between the two last columns, opposite the entrance, was one Corinthian column. These 11 columns supported a frieze of more than 100 feet in length, by 2 feet, 1½ inch high, decorated with representations of the war of the Centaurs and Lapithæ, and of the Greeks and Amazons. This master-piece of sculpture is now in the British Museum. The walls and columns of this temple were built of limestone, but the roof was constructed of marble.

Among many ruins at Olympia, are those of the temple of Jupiter, which the Eleans caused to be built in the year 450 B. C. by Libon from the booty gained in their wars (*pl.* 10, *fig.* 1, front elevation; *fig.* 2, longitudinal section; *pl.* 15, *fig.* 3, half front; *fig.* 4, half lateral section of the pronaos; *fig.* 5, lateral section of the cella and porticoes). The outer walls of this temple were plastered with stucco $\frac{1}{10}$ of an inch thick, and the roof, which was reached by winding stairs, was covered with Pentelican marble. On each front there were two rows of six Doric columns each, and 17 on each side 6 feet in diameter. Inside were two rows of columns placed in two tiers, and the temple was hypæthral. The length of the temple, which numbers among the largest in Greece, was 218 feet, by 94 feet in width, and 64 feet in height. The side walls were painted by Panænus, brother of Phidias, but the gable fields are decorated with *haut-reliefs.* Those of the front by Pæonius represented Pelops and Œnomaus preparing for a chariot race in presence of Jupiter; whilst those of the rear by Alcmenes, exhibited the combat of the Centaurs and Lapithæ at the wedding of Pirithous. The doors of the temple were of bronze, decorated with representations of the labors of Hercules. The architrave contained 21 gilded bucklers, a donation of Mummius the Roman general, after his victory over Corinth.

Several monuments in Attica are worthy of special notice. On a plateau about 300 feet above the level of the sea, near Rhamnus, 60 stadia from Marathon, are the ruins of two temples inclosed by a peribolus; the largest

consecrated to Nemesis, the smaller to Themis. The former (*pl.* 12, *fig.* 13, front; *fig.* 14, and *pl.* 16, *fig.* 23, ground plans) was a peripteros with six Doric mantled columns in front, and twelve on the sides. The members of the entablature show marks of painted ornaments. The height of the building was 70 feet, 5 inches, by a width of 32 feet, 10 inches; the diameter of the columns, which were 13 feet, 1 inch high, was 2 feet, $4\frac{1}{3}$ inch; the entablature was 4 feet, 4 inches high. The ceiling and roof are constructed in a superior style, and their ruins are very instructive with regard to the rules by which the ancients connected stone blocks. Seven columns of the temple and one of the pronaos are still in good condition, and the three steps of the substructure show that the columns were placed over quadrangular grooves several inches deep, and probably intended to receive metal plates. The temple of Themis (*pl.* 16, *fig.* 33, plan) had two Doric columns between the corner pillars, and was 32 feet, 3 inches long, by 20 feet, 10 inches wide. It was erected at the time of Pericles, and destroyed by the Persians.

At Sunium are two remarkable ruins, the one the remains of the temple of Minerva Sunias, and the other of its propylæa, which are very similar to those of the temple of Diana at Eleusis. Both these monuments are of the Doric order, and very carefully constructed of white marble. Of the temple there remain nine columns of the western side, three of the eastern, and the corner pillars and two columns of the pronaos. It had six columns in front, and 13 at the sides. Of the interior no traces are left, and it is therefore not well ascertained whether the vestibule inserted in our ground plan (*pl.* 16, *fig.* 19) from the plan of the Parthenon, really existed.

We now proceed to the Grecian monuments in Asia Minor, commencing with the island of Delos, where we find the ruins of the temple of Apollo built of Parian marble, of which nothing remains but three Doric mantled columns of 3 feet, 1 inch diameter, and 18 feet, 8 inches high, with an entablature of 5 feet, $9\frac{1}{2}$ inches (*pl.* 19, *fig.* 2, a capital). A few fluted Doric columns of a portico ascribed to Philip of Macedonia on the strength of an inscription on the same, are found near this temple. They are 19 feet, 4 inches high, by 2 feet, 11 inches diameter. The flutes descend only to within six feet from the ground, the lower part of the shafts being polygons with smooth faces. The capitals have but very little projection, and an almost straight echinus. Near this place are also some ruins of square pillars, the capitals of which are formed by the heads and shoulders of four oxen, in the manner of the horse capitals in the monument of Nakshi Rustam (*pl.* 3, *fig.* 6).

Sardis, the metropolis of Lydia, at the foot of Mount Tmolos, contains the ruins of the temple of Cybele. This temple, of the Ionic order, was a dipteros, but with three rows of columns in front (*pl.* 10, *fig.* 17, elevation; *pl.* 11, *fig.* 13, plan).

Of all the monuments of Mylasa, a place eighteen hundred years ago remarkable for its numerous temples, colonnades, and buildings of every description, nothing remains but a Corinthian column without the capital, erected in honor of the sovereign of Caria, and the ruins of a temple dedi-

cated to Rome and Augustus and of a beautiful gate of the Corinthian order (*pl.* 18, *fig.* 22, view; *fig.* 23, plan.) About a mile from the city are the ruins of a mausoleum of a very inferior style. The corners are formed by square pillars between which a couple of slender pillars are placed, with half columns attached to them inside and outside. The Corinthian columns and pillars are fluted on the two upper thirds and plain below. The substructure supports over a panelled ceiling a pedestal composed of steps, which probably once supported a statue. The frieze is convex.

Halicarnassus, situated on a safe and extensive harbor, the native place of Herodotus, contained the temples of Mercury, Venus, and Mars, and the marble-faced royal palace. In the centre of the city was the mausoleum erected in honor of the memory of King Mausolus, by his disconsolate widow Artemisia (*pl.* 13, *fig.* 19, elevation; *fig.* 20, side view; *fig.* 21, section; *fig.* 18, ground plan). The building is entirely destroyed. Some of the columns and sculptures of it were probably used in the construction of the royal palace. Our illustrations have been made from a medal (*fig.* 22, *a*, *b*), whose obverse showed the portrait of Artemisia, the reverse the mausoleum, and from ancient descriptions. The mausoleum, erected 353 B. C., was 140 feet high, and 411 feet in circumference. The substructure supported 36 Ionic columns, crowned with a rich entablature. The roof was formed by a series of steps, whose top supported the triumphal chariot with four horses, by Phytio. The four sides of the substructure were decorated with sculptures by Braxis, Leocharis, Timotheus, and Scopas, who, after the death of Artemisia, completed them without remuneration for the sake of their own reputation and fame. The building was destroyed by Alexander 334 B. C. during the siege of Halicarnassus.

Pl. 10, *fig.* 22, shows the elevation, and *fig.* 23, the plan (in which, by mistake, two columns of the sides and the posticum have been omitted) of a beautiful Corinthian temple at Euxomus in Ionia. The temple, probably erected in the time of Hadrian or Antonine, had six columns in front and eleven on the sides, with magnificent capitals and bases.

The temple of Apollo Didymæus, one of the largest in Greece, was located near the city of Miletus, on the cape Branchidæ. It was of the Ionic order, hypæthral, with ten columns in front and two rows of 21 columns on each side (*pl.* 12, *fig.* 3, front elevation; *fig.* 4, plan). The columns were 6 feet, 3 inches in diameter, and 63 feet, 1 inch high; the height of the entablature was 7 feet, 4¾ inches. The capitals of the pillars are ornamented with bas-reliefs, and the capital of the only remaining Corinthian column is one of the most beautiful in existence, and has been frequently imitated. The whole length of the temple was 295 feet, 9½ inches, by a width of 156 feet, 7 inches.

At Priene, on the right bank of the river Mæander, are the ruins of the temple of Minerva Polias, built by Pythius under Alexander, 334 B. C. (*pl.* 16, *fig.* 18, plan). It was an amphiprostylos peripteros of the Ionic order, with 6 columns in front and 11 on each side; 122 feet, 5½ inches long, by 64 feet, 3 inches wide, exclusive of the three steps. The columns were 4 feet, 8 inches in diameter, by 36 feet, 11 inches in height.

The magnificent temple of Diana in Magnesia (*pl.* 12, *fig.* 7, elevation; *fig.* 8, ground plan), which, according to Strabo, was the largest of all temples in Asia except the temple of Ephesus, was of the Ionic order, with 8 columns in front and 15 at the sides. No trace of it is left, and our illustrations are derived from the descriptions of Strabo and Vitruvius.

Of the temple of Diana at Ephesus, renowned as the most exquisite building in Asia, only a few ruins of the substructure are left. From ancient descriptions we have gleaned the details given in our illustrations (*pl.* 12, *fig.* 1, elevation; *fig.* 2, plan). The temple was destroyed five different times and as often rebuilt. After the fifth destruction the Greeks resolved to erect the costly building of which we here give the outline. The plans were made by Ctesiphon of Gnossus on the island of Crete, who here first introduced the Ionic order, whose capital he had probably seen in the temple of Chalembaram in India. The construction was commenced by Theodorus, towards the end of the seventh century B.C., who made a firm ground by piles, the natural ground being swampy and unsafe. After the death of Ctesiphon, the building was continued consecutively by Melagenes, Demetrius, and Pæonius, who finally completed it 480 B.C., the whole work having occupied 220 years. According to Vitruvius the temple was a dipteros with 8 columns in front; 425 feet long, by 220 feet wide, and hypæthral. It had 127 columns, donations of the Asiatic kings, the largest of which were 60 feet high, by 7½ feet in diameter. On the day when Alexander was born Herostratus set fire to the temple, of which, however, only the cedar roof could be consumed; but the heat converted the marble columns in the cella into lime. Fourteen years later the restoration was commenced, about the manner of which there is a great diversity of opinion among archæologists. From the reports of Vitruvius it would appear that the old plan was followed, and as he names a group of 36 columns which are also mentioned by Pliny, some authors are of opinion that these must have been in the cella, forming two double rows of 9 pairs or 18 columns on either side. This would leave 91 for the outside. Now Vitruvius gives 8 columns at the front and 17 at the sides, which makes 84, the temple being a dipteros; then there are mentioned 4 in the pronaos and 2 in the posticum, making the number of the columns outside the cella 90; and as the last single column can be assigned to no special place, archæologists surmise that there was a mistake in the ancient manuscripts, and that the number of columns in the building was written CXXVII., by mistake for CXXVI. We cannot admit the probability of such a conclusion, as it is based upon the presumption that two authors have made the same error. The view of the distinguished archæologist, Luigi Canina, appears much more likely, and from his disposition of the columns our drawing has been made. According to him the new temple had 10 columns in front, 19 at the sides, 4 both in the pronaos and posticum, 8 on either side of the cella, with 3 at the lower end behind the sanctuary between them, which brings in exactly 127 columns, without violating any rule of architecture.

The northern barbarians under Rapsa completely destroyed this mag-

nificent edifice, 262 A.D., and carried a number of the columns to Constantinople.

Besides the temple of Diana, Ephesus contains the ruins of a temple of the Corinthian order, the foundation walls of an extensive theatre, and three lower and six upper arches of an aqueduct erected by Tiberius. About four miles northwest of Ephesus was Teos, the native place of Anacreon, with a temple of Bacchus (*pl.* 12, *fig.* 5, plan; *fig.* 6, elevation). It is of the Ionic order; the columns 3 feet, 3½ inches in diameter, by 25 feet in height, and all the proportions and details of a superior character and style. The temple was built 400 B. C., by Hermogenes.

Grecian architecture was at an early period introduced by emigrants into the colonies in the southern districts of Italy and the island of Sicily. Though the exact time of its introduction has not been determined, it is quite certain that elegant Grecian structures were in existence at Sybaris as early as 740 B. C., and that in the fifth century B. C., Grecian architecture was generally adopted in the erection of temples, theatres, and halls. Of all the ruins of purely Greek structures those of Pæstum, a city founded about 520 B.C. by the Sybarites, who had been driven from their country by the Crotoniats, are in the best state of preservation. The most remarkable among them is the temple of Neptune, known as the large temple at Pæstum (*pl.* 12, *fig.* 9, view of the ruins; *pl.* 10, *fig.* 20, *pl.* 15, *fig.* 1, restored elevation; *fig.* 2, and *pl.* 10, *fig.* 21, ground plan; *pl.* 20, *fig.* 8, the columnar order; *pl.* 19, *fig.* 1, a capital). The temple forms a parallelogram of 155 feet length, by a width of 75, with a portico of 36 Doric columns all round, which is approached by three steps. In the interior there are two rows of columns surmounted by architraves only, which must formerly have supported a second tier of columns, and it is therefore supposed that the temple was hypæthral. It had 6 columns in front and 14 at the sides, those near the corners being a little thicker and placed closer than the others, but all without any swelling. The architraves in the interior are connected with the wall of the cella by stone beams which must have supported the floor of the galleries, which were approached by stairs in the pronaos. The walls of the cella have only the height of the architraves on the lower columns, and it appears that they must have been surmounted by some contrivance for admitting light into the cella, similar to that of the hall at Carnak (p. 13). Some writers are of opinion that this upper sidelight is exactly what the Greeks termed hypæthros, and that they therefore derived the latter from Egypt.

The temple of Ceres, known as the smaller temple at Pæstum (*pl.* 11, *fig.* 18, *pl.* 15, *fig.* 14), has 6 columns in front and rear, and 13 on each side. The columns of the peristyle are still standing, whilst in the pronaos only the bases and part of the shafts are left. The second row of columns is elevated one step above the first, and is one step lower than the two rows in the rear. These columns are the only Doric ones with 24 flutes instead of 20. The capital (*pl.* 19, *fig.* 3) differs from the ordinary Doric in the construction of the neck. The columns of the pronaos are the only Grecian Doric columns with a base.

The Basilica of Pæstum was also of the Doric order, with capitals like those in the temple of Ceres, but with considerably swelled shafts. The building (*pl.* 10, *fig.* 24, elevation; *fig.* 25, plan) was 160 feet in length, by 75 in width, and had 9 columns in front and rear, and 18 on the sides. In the interior, opposite to the third columns of the front and sides, are two pillars, with three columns between them, and it is probable that there was a similar arrangement in the rear. The walls marked in the plan probably supported upper rows of columns. In the centre was another row. The whole was thus divided into four naves between five rows of columns, which were connected by beams resting on the outside entablature, and supporting the roof. The building was probably used as a market hall, like the Stoa at Athens.

The Island of Sicily had at one time still more remarkable monuments of architecture than Greece itself, but in consequence of the wars of the Carthaginians and the Romans, during which many of them were entirely destroyed, only few and unimportant ruins have been preserved to the present time. At Syracuse are the ruins of the mausoleum of Archimedes, a few rock-cut stairs of a theatre, and twelve Doric columns of 6½ feet in diameter, which formed part of the magnificent temple of Minerva (*pl.* 15, *fig.* 19, plan), and are introduced in the new cathedral. The doors of the temple were of bronze, inlaid with gold and ivory. A number of excellent paintings belonging to the temple were carried to Rome by Verres.

The city of Agrigentum, the largest on the island next to Syracuse, contained a temple of Minerva, located on the plateau of the rock at the foot of which the city lay, of which no traces are left. There are considerable remains of a Doric temple of Juno Lucina, which was erected on a plinth 10 feet high, and had 6 columns in front and rear, and 13 on each side. This temple contained one of the best works of Zeuxis, a picture of Juno.

Another temple has been almost entirely preserved. It was consecrated to Concordia, situated on a hill covered with trees of the aloë family, built of a bright yellow limestone upon a substructure of six steps. It is one of the most beautiful Grecian monuments, exhibiting exquisite proportions (*pl.* 10, *fig.* 18, elevation; *fig.* 19 and *pl.* 11, *fig.* 14, plan).

The temples of Æsculapius, Hercules, and Jupiter, have almost entirely disappeared. The latter temple, also called the Temple of the Giants, was 340 feet in length, by 160 feet in width, and 120 feet in height. It was a pseudodipteros, and the columns were 66 feet high, by 9 feet in diameter. There were eight in front and rear, placed at distances of one diameter. The flutes were so wide and deep that a man could find room in their recess. Fragments of colossal statues have been found, which apparently supported some part of the building. They probably stood on half side-walls of the cella, with the architrave resting on them, thus forming openings to admit light into the interior. The temple, erected 420 B.C., was destroyed by an earthquake, and its materials were used for the quays of the harbor.

The colossal ruins at Selinuntiæ, the present Pillori, are very remarkable, and unmistakably of Grecian origin. The place was sacked by Hannibal,

and earthquakes have completed the work of destruction. Its largest temple was that of Jupiter Olympius (*pl.* 12, *fig.* 10, elevation; *fig.* 11, plan). It was a pseudodipteros of the Doric order, with 8 columns in front and 17 at the sides, 48 feet, 7 inches high, by 10 feet in diameter. It was a hypæthral building, 311 feet long, by 158 feet in width, and stood on an isolated hill in the plain of Selinuntiæ, upon a substructure on which two other Doric temples were also erected. The first of the latter (*pl.* 11, *fig.* 16, plan) is very much dilapidated. Its proportions were 216 feet, by 94, and its fluted columns were 32 feet high, by a diameter of 6 feet, 7 inches. The other (*fig.* 17, plan) was 174 long, and had columns of 5 feet, 6 inches in diameter. Both these temples had columns all round, the former being a pseudodipteros, with two rows of columns in the pronaos, separated by a double columnar distance.

On the acropolis are three Doric peripteros temples, the smallest of which (*pl.* 16, *fig.* 21, plan) is the southernmost. Between it and the next towards the north there is a small Ionic temple of only 16 feet front, with a portico of four columns. It has the peculiarity of having its pure Ionic columns surmounted by a Doric entablature, whose architrave, instead of the three Ionic stripes, exhibits two painted ornamental stripes, the third being replaced by the tænia with the drops. The triglyph capitals, as well as the panels and the cyma of the cornice, are painted.

The rival city of Selinuntiæ was Segeste, the ally of Athens by which she was assisted in her unfortunate expedition against Syracuse. According to Cicero, her founder was Æneas, to whom one of her temples was consecrated. The only traces of the former splendor of this city are the ruins of a theatre, of the cisterns, and of a temple before the city attributed by some to Venus, by others to Diana. This temple, a view of which in its present condition is given on *pl.* 9, *fig.* 6, is in tolerably good preservation, except the roof. It has Doric mantled columns, 6 in front and rear, and 14 at the sides, placed on a substructure of three steps. Its proportions are 177 feet, by 74. The walls are executed in bound masonry of tufa. Each column consists of 12 or 13 stone rings, and is 31 feet high, by a diameter of 6 feet, 7 inches.

It is a remarkable fact that all the remains of ancient buildings in Sicily are of Grecian origin. All the temples, except the smallest in Selinuntiæ, are of the Doric order, and have capitals as bold and prominent as the oldest ruins in Greece. The most recent monuments date from 400 B.C., and the two temples of Jupiter at Agrigentum and Selinuntiæ have columns of a greater diameter than any temple in Greece.

In conclusion of this account of Grecian architecture we offer, from the illustrations given, and the short explanations of the same, the following general remarks:

1. The order principally adopted in Grecian buildings was the Doric, which was brought to the highest perfection of noble simplicity and exquisite proportions by the Greeks. The fluted columns, which were introduced into Greece from Egypt, are of older date than the smooth or mantled column.

2. The Greeks borrowed from the Egyptians the form of these temples and the method of surrounding them with columns, but added to the Egyptian entablature the frieze and the peculiar cornice, as well as the roof and gable.

3. The Doric order was ever faithfully adhered to by the Sicilian and Italian Greeks. The Ionic order was first introduced in the seventh century B. C., in the temple of Ephesus; it was introduced into Greece in the beginning of the 5th century B. C.: after 410 B. C., no new Doric buildings were erected in Ionia, and none in Attica and Peloponnesus after the middle of the 4th century B. C.

4. The Corinthian order occurs in no ancient building in Greece in the manner observed in Palmyra, Baalbec, and Rome. The comparatively few capitals of the Corinthian form met with in single buildings constitute no distinct order; the Corinthian capital was therefore, in all probability, not invented by the Greeks.

5. The Grecian style of architecture adhered, even in the most magnificently decorated buildings, invariably to a noble simplicity. The ornaments were masterpieces of painting or sculpture, which shared their claim to the attention of the beholder with no gaudy embellishments.

6. The exterior of the Grecian temple had no decorative ornaments; everything is based upon constructive architectural necessity; the mouldings of the cornice had a bold and beautiful profile.

7. The Grecian architects knew how to increase the effect of their buildings by erecting them in groups in the same place, or on or near a hill, producing, as it were, architectural pictures.

8. A careful survey and examination of the remains of Grecian monuments shows that the Grecian architects, in their designs for entire buildings as well as for details, never strictly followed monotonous rules, but preferred a well regulated variation, and understood how to make a tasteful choice between the largest and smallest proportions.

5. Phœnician or Syrian Architecture.

The ruins of buildings at Palmyra and Baalbec are the only specimens of Syrian architecture which offer any chance for the study of the art of that country, all the remarkable and magnificent buildings which, according to the narratives in the Bible and the poems of Homer, existed in the cities of Tyre and Sidon, having entirely vanished from the surface of the earth, and no excavations having as yet been made.

Turning our attention first to the ruins of Palmyra, we find as the most prominent those of the Temple of the Sun (*pl.* 12, *fig.* 12, view, including part of the peribolus; *pl.* 13, *fig.* 6, plan). It was surrounded by a spacious court whose outer wall was lined with colonnades and had window-like openings. In the middle it had a double portico with gables and a highly decorative cornice (*pl.* 19, *fig.* 29, fragment). The temple itself had 8 Co-

rinthian columns at the short sides and 15 on the eastern long side, whilst the western had only 12, and two strong pillars between which lay the entrance, a remarkable difference from the Grecian temples, which always had the entrance on the shorter side. These pillars had half columns at the fore corners and at the sides. The substructure of the temple is formed by nine steps. The columns are of the Corinthian order, 51 feet high, by a diameter of 4 feet, 8 inches, and placed on cubes. From the Attic base up to the height of 5 feet, the shafts exhibit convex beads, and from this height upwards to the capitals they are fluted. Each short wall had two Ionic half columns on the outside. The entablature is very rich, the frieze decorated with genii and garlands of flowers. The cella is 122 feet by 39, has a highly finished door on the long side, and eight windows; at both ends winding stairs lead to the roof. The ceiling above the two altars is richly decorated with sculptures, including a zodiac and deities in hexagonal panels, among which are Baal, Cronos or Moloch, Baaltis, Melcarthos, Adon, Mercury, and Astarte, corresponding to the Grecian deities Zeus, Artemis, Pluto, Helios, Poseidon, Hermes, and Here.

About 1440 feet from the northern corner of the peribolus are the ruins of a triumphal monument composed of three arches, the two smaller ones of which open into covered colonnades, 16 feet wide, and 4000 feet long, with a street between them of 37 feet in width. The columns are 3 feet, 3 inches thick, 28 feet high, and support a very rich entablature. The ceiling was composed of stone blocks, 20 feet in length. Judging from the remaining columns and their distances, the total number of columns must have been 1450. Nearly in the middle of the street between the colonnades are four large pedestals which formerly supported groups. of sculptures (*pl.* 17, *fig.* 22 *a*, plan; *fig.* 22 *b*, elevation of one pedestal). At this place a circus of 10,000 feet in length abuts on the colonnades; this was also surrounded by columns, all of which, however, are lying in ruins. The colonnades end at a monument, by some considered to be a temple of Neptune, by others a mausoleum (*pl.* 16, *fig.* 27, plan). Its entrance was guarded by two winged genii, each soaring on a sphere. The six columns in front are of the Corinthian order and smooth, 2 feet, 11 inches thick, by 27 feet, 4 inches in height, placed on cubes of 2 feet, 11 inches, and supporting a gable, whilst they form a portico. The altar in the rear of the cella was surrounded by four columns supporting the richly decorated ceiling.

Beyond the circus are the ruins of five small Corinthian temples and of two other buildings. Between the Temple of the Sun and the opening of the colonnades is a single Corinthian column, 54 feet high and 5¼ feet thick, and another, 60 feet high, stands to the right of the colonnade. Both once supported statues. Near by is still another monolithic granite column 28 feet high, and at a short distance from it the ruins of the peristyle of a temple. West of the temple of Neptune are several important ruins, among which are those of a large palace, probably the palace of Odonatus, consort of Zenobia, or perhaps the assembly house of the city authorities. To the right of the colonnades is a small but beautiful temple (*pl.* 16, *fig.* 22, plan). It has smooth Corinthian columns, 28 feet high, and 3 feet,

1 inch thick, with the Attic base, which appears to have been generally adopted in Palmyra. The portico has 4 columns in front and 2 at the sides; the cella 4 corner pilasters; it is only 30 feet long, and has two windows, which, like those of the Temple of the Sun, prove that the ancients did not always avoid side-light in their temples.

In Heliopolis, or Baalbec, as in Palmyra, the most important ruins are those of the Temple of the Sun (*pl.* 13, *fig.* 2, plan). It consists of four large divisions, of a total length of 940 feet. The first division consists of a flight of steps, and the adjoining portico of 12 Corinthian columns, 42 feet, 8 inches high, and 4 feet, 3 inches thick, and beautifully moulded. Above the entablature was a low wall with bottom and top cornices, probably a later addition to replace a destroyed gable. The portico has two side halls and two gates in the rear wall. The second division is a hexagonal structure inclosing a large open court. Five sides of this building, including the one in the rear of the portico, formed as many halls, bounded towards the court by Corinthian columns, 26 feet high, and 2 feet, 9 inches thick, placed on isolated pedestals, 5 feet, 6 inches high. The halls were 60 feet long, by a width of 22 feet, and their side and rear walls were lined with two tiers of columns, the upper ones connected in pairs by gables. Between these halls were nine other smaller apartments, which, like the halls, may have been occupied by the priests. The court is 193 feet wide, and at present filled with ruins. The third division of the monument is a large quadrangular open court, 350 feet long, by 336 feet in width, three of whose sides, including that adjoining the hexagonal court, are formed by eight halls, 58 feet long, 22 feet wide, and 36 feet high, together with four semicircular and several smaller quadrangular apartments. In front of each hall stood four smooth Corinthian columns, 28 feet high, and two similar ones in front of each semicircular apartment. These 40 columns were exactly like those of the first court. The interiors of the halls exhibit similar double tiers of columns along the walls with the first halls, connected in pairs alternately by triangular and arched gables. The columns are 10 feet high, and the halls contain the total number of 352. In each niche formed by two connected columns was placed either an altar or a statue. Each of the semicircular apartments had five niches, decorated with pilasters supporting columns also connected in pairs by gables. They contained 40 such columns. In the rear of this court was the temple proper, the fourth division of the grand monument. It was 268 feet long, by 146 in width, and its peristyle was approached by several steps. It had 10 columns in front and rear, and 19 at the sides, of 72 feet, 5 inches in height, by a diameter of 7 feet. The gable and the cella are entirely destroyed. The buildings of the two first divisions stand over vaulted subterranean apartments, 23 feet high.

Another very remarkable monument in Baalbec is the temple of Baal or Jupiter, situated by the side of the quadrangular court of the Temple of the Sun, and of which we have given several illustrations (*pl.* 13, *fig.* 1, view; *fig.* 3, and *pl.* 16, *fig.* 16, plan; *fig.* 13, view of the interior through the large gate). This temple is a peripteros with two rows of 8 columns in front, one row in the rear, and 15 at the sides. They are of the Corinthian

order, 62 feet high, by a diameter of 6 feet, 5 inches, and placed on plinths 2 feet high. The portico has a gable, and is approached by a flight of steps 17 feet high, or one seventh of the entire height of the temple. The second row of columns is only 56 feet high, and fluted. The columns of the peristyle are richly and tastefully ornamented, and the frieze has a very peculiar decoration. The spaces between the centres of the columns are divided into five parts, each with a foliated consol standing on the cymatium of the architrave, and supporting busts of animals, on which rests the cornice of the roof. These busts are connected by festoons of flowers. In the interior of the cella are at each side 6 fluted half columns, one quarter column, and one pilaster. Between the half columns are arches forming niches and supporting two small columns surmounted by a projecting gable, between which there were probably statues. The gate of the temple is of a bold profile, and, like the ceilings of the portico and pronaos, very richly decorated. The ceiling of the cella was arched with splendidly ornamented braces. The proportions of the cella are 114 feet, by 70, and it has no windows.

Besides the described monuments, Baalbec contains the ruins of a round temple, 32 feet in the clear, surrounded by six Corinthian columns, 29 feet high, and erected on a substructure 12 feet in height. In the interior it had a double tier of 14 Ionian columns below and 14 Corinthian above, and a number of small round and triangular gables. There are also some huge ruins, probably belonging to an ancient building of the Tuscan order, judging from an isolated granite column 60 feet high, 5 feet, 6 inches thick, smooth, and composed of 18 pieces, near the Temple of the Sun, and some enormous blocks of stone near it, which lie on a wall 20 feet high, and whose extraordinary proportions are 60—70 feet length, by a width and thickness of 12—14 feet.

We have, in conclusion, to add a few remarks on the period when the structures at Baalbec were probably erected, and by whom. According to the Bible (2 Chron. viii. 4, and 1 Kings ix. 18), a city was built by Solomon on the site of the present ruins of Palmyra about 1011 B. C., which, according to Flavius Josephus, was surrounded by a wall. The name of this city was Tadmor (city of palms), and on account of its favorable location between Jerusalem, Tyre, Sidon, and Babylon, it soon became an important emporium of commerce, and must have been a splendid place when it was sacked by Nebuchadnezzar 600 B. C., together with Jerusalem and Tyre. From this time forward New Tyre, the former port of Old Tyre, must have made rapid progress in wealth and civilization by the concentration of the world's commerce. Herodotus found there as early as the fifth century B. C. a temple of Melcarthos or Hercules, containing a statue of gold, and another of emerald. Tadmor is not mentioned again by ancient writers. It occurs again as Palmyra under the Seleucides (successors of Seleucus Nicator), about the middle of the third century B. C.; and it is probable that the buildings of Palmyra were erected before this time. At all events, it was before the conquest of Palmyra by Pompey (63 B. C.), for the inscriptions on the building are Palmyrenian. At the beginning of the first century B. C. Palmyra was a rich and influential place, whose alliance was coveted

by the Romans, and as late as 260 A. D. it is mentioned as an important city. It is therefore very probable that the monuments at Palmyra belong to the second and third centuries B. C.

Baalbec was also founded by Solomon (1 Kings ix. 18), and called Baalath. In the year 59 A. D. when Crassus plundered the Temple of the Sun it was a renowned building, and Baalbec existed still in its full splendor under Augustus, when it was called Julia Augusta. Herodotus mentions the columns at Baalbec as surpassing all other known columns in height, and since the buildings still standing are of a more recent date, it is probable that he refers to the building of which we suppose the single Tuscan column to be a remnant. The magnificent structures of Baalbec must, however, have existed for centuries before the incursions of the Romans, for if they had built them their historians would have chronicled the fact.

But the proof that the monuments in Syria were built by native architects, and that their style was original and not copied from Roman patterns, can be furnished architectonically as well as historically, and in our account of the Roman Monuments we shall moreover prove that the Romans never had any original style of architecture of their own. Our arguments for the originality of the Syriac monuments are the following: 1. All temples of the Greeks and Romans had the entrance on the shorter side; the Temple of the Sun at Palmyra had it on the long side. 2. All Roman temples are but slightly longer than broad; those at Palmyra and Baalbec had a length of more than double their breadth. 3. The ornaments on the friezes, &c., in Syria are so peculiar as to vary materially from the Roman, and contain mystic emblems belonging to an ante-Roman period; for instance, the personification of Baal and winged genii, which do not occur on any Grecian or Roman building of that period. 4. The abaci of all the Corinthian capitals of Palmyra have truncated corners, whilst in all the buildings erected during the reign of Hadrian we find sharp-pointed corners on the abacus; after the conquest of Syria by Pompey Roman buildings show also the truncated abacus, which must therefore have been introduced from Syria. 5. The same may be said with regard to the modillions in the cornice, which do not occur in Roman buildings until after the conquest of Syria. 6. The Syriac columns are generally higher than the Grecian or Roman. 7. The grandeur of the Syriac monuments so far surpasses that of the Roman that the 846 columns of Baalbec and the 2000 and more of Palmyra (of from 42–70 feet in height) would have sufficed to furnish all the known public buildings of ancient Rome. How insignificant does not the *largest* Roman temple appear in comparison with the *smaller* temple of Baalbec? Can it be supposed that the Romans should have erected such edifices in a foreign country in preference to their own capital? 8. The rich ornaments on the window-frames, door-jambs and lintels, and the small round or triangular gables over windows and doors, do not occur in Roman buildings until after the conquest of Syria, where they had then existed for centuries in the wealthy city of Tyre. And finally, the placing of statues on consoles attached to the shafts of columns was not introduced either in Greece or in Rome until after that period.

All these facts must suggest the conviction that the Romans had no part in the erection of the buildings of Palmyra and Baalbec, and that they were not executed by the Seleucides is evident by a glance at the cities of Seleucus, Antiocha, and Damascus, which only contain fragments of *small* columns. The magnificent edifices of Syria are not therefore copies of Roman buildings, but in many respects their prototypes, and it is not unlikely that the Corinthian style of architecture originated in Phœnicia.

6. Roman Architecture to the Time of Constantine the Great.

The higher architectonic art was introduced into Italy from foreign countries, especially into Etruria by Phœnician colonists, and into the southern parts by Grecian settlers; and as both these people at first practised the art in the manner of their respective countries, we find in the oldest Italian monuments the Doric and Tuscan orders separately, but at a later period an amalgamation or rather mixture of the two. This is clearly perceptible in the plans of temples. The Tuscan temple is nearly an exact square, the Grecian a quadrangle with a length about double its breadth. The Etruscans introduced into Italy the art of arching, which they had learned from the Phœnicians, and as early as the 6th century B. C. arched the *Cloaca Maxima*, when in Greece no trace of a regular vault was as yet found. We shall consider the ancient architecture of Rome in three periods: that of the kings, of the republic, and of the emperors.

A. The Period of the Kings.

Of the oldest edifices of central Italy few or no traces are left; and, though the city of Ægillæ, in the neighborhood of Rome, in the time of the first Roman kings, formed a state of as much consequence as Rome itself, and the Tyrrhenians at that age were renowned for their skill in naval affairs as well as for the comfort of their dwellings, we are so completely without reliable information about their structures that with regard to the oldest Italian architectural history we can consider only the edifices of Rome. This unimportant colony had under the three first kings gradually risen to be a large city, so that Ancus Marcius, the fourth king, was compelled, on account of the increase of the population, to extend the confines of the city beyond the Tiber, so as to include the Aventine and Janiculan hills, which he furnished with walls and entrenchments, and connected with the city by a wooden bridge. He also founded the port of Ostia, extended the temple of Jupiter Feretrius, which Romulus had built, and caused the first prisons to be built in the quarries, leaving their completion to Servius Tullius. Remains of these prisons are still found in the neighborhood of the Forum, but they are of a more recent restoration of the same. The older Tarquin improved the walls of the city, founded the Forum for public assemblies of the mass of the people, and the large racecourse (*Circus Maximus*), besides beginning the work of the great system of sewers. He caused the top of the Tarpeian rock to

be smoothed for the erection of the temple of Jupiter Capitolinus, the foundation of which was made by him. His successor, Servius Tullius, added the Quirinal and Viminal hills to the city, and enlarged the district of the Esquiline. The walls and entrenchments which he completed remained unaltered until the latest times, as the city, after his day, was enlarged only by suburbs. He also erected on the Aventine hill a temple of Diana, designed as a sanctuary common to the allied cities of Latium, as was the temple of Diana at Ephesus to the allied cities of Asia. No trace of it is left, and it must have been vastly inferior to the magnificent edifice of Ctesiphon. Two other temples are attributed to him, viz. that of Bona Fortuna in the Forum Boarium, and that of Fortuna Virilis on the bank of the Tiber. A restoration of the latter, probably made under one of the later emperors, still exists (*pl.* 16, *fig.* 7, front; *fig.* 8, plan; *pl.* 19, *fig.* 7, a capital). It is a pseudoperipteros with four Ionic columns in front, a portico of two columns, and five half columns at the sides. The columns are 25 feet, 5 inches high, by a diameter of 2 feet, 11 inches, and are made of travertine marble, whilst the walls are of tufa. They have 20 flutes, but their capitals, with concave faces between the volutes, look less graceful than the chaste Grecian capitals of the same order. The temple with the entablature has had a plastering of marble dust, of which traces are perceptible. The temple of Jupiter Capitolinus was not continued under Servius Tullius. It was again taken up by Tarquinius Superbus, who, however, was banished before its completion, which was finally accomplished in the third year of the republic, when it was consecrated by the consul Pulvillus. It was destroyed by fire 415 years later, during the consulate of L. Scipio and C. Norbanus. It stood on a high substructure, and had 800 feet in circumference, the difference between its length and breadth being only 15 feet. The southern or principal front had three rows, the other sides two rows of distantly placed columns. The entablature was of wood. It was of the Tuscan order, with proportions in altitude like the Doric. Its three naves were consecrated respectively to Jupiter, Juno, and Minerva. Tarquinius Superbus built also, with the assistance of the 47 cities of Latium, a temple on the Alban mountain, in which sacrifices were offered down to the latest time of heathenism. Only a few blocks of tufa are left to mark its site.

B. The Period of the Republic.

The banishment of the kings took place in the 244th year of the city, or 509 B.C. The first years of the republic were marked by considerable architectural improvements. On the road from the Forum to the Capitol a temple of Saturn was erected, which for several centuries was used as the state treasury. Soon after, the dictator Posthumius erected two temples dedicated to Ceres and to Castor and Pollux, 482 B.C. The latter was located near the Forum and the temple of Vesta, and was rebuilt by the emperor Augustus. The former stood above the circus, on the slope of the Aventine hill, and was dedicated, besides, to Ceres, Bacchus and Proser-

pine. Both temples were built by Damophilus and Gorgasus, the first Grecian architects in Rome.

It will be appropriate to insert here a few remarks on the Tuscan style of architecture, which about this period was introduced into Rome by Etruscan architects, and adopted in all the principal buildings. The columnar proportions were similar to the Doric, 5 or 6 diameters in height, the difference being in the columnar distances, which with the Tuscans were much wider, on account of their constructing the entablature of wood, mostly without any frieze, the rafters being cut off slantingly and covered with a board. To their columns they gave a round plinth and a very simple capital. The ornaments were of burnt clay. At a later date the Romans adopted the nobler Doric style, and the Tuscan was only retained in central Italy. The style of the Doric monuments in Rome was long that which we have mentioned in our description of the monuments of Pæstum, whilst in Greece it had already been materially improved.

In the year 434 B. C., the Villa Publica was built at Rome for the administrative assemblies, and in the year 430 B. C., the temple of Apollo was consecrated. Next followed the very important work of connecting the Alban lake, which occupies an extinct crater, with the city, by an aqueduct 7500 feet long, 7 to 8 feet high, and 5 feet wide, which is still in use. After the conquest of Veii, 395 B. C., the tutelar goddess Juno of this city was transported to Rome, and a temple built on the Aventine hill to receive the statue.

Up to this time the city and state of Rome had always been fortunate in war; but in the year 378 B. C., it was conquered by the Gauls and laid in ashes, with the exception of a few temples. As early as one year later, it was already rebuilt, but without any regular plan, and partly of sun-dried bricks, on solid substructures. In the year 365 B. C., when the people had obtained the right of electing a consul from among themselves, and all internal feuds had been discontinued, the temple of Concordia was built on the slope of the Capitoline hill, of whose later restoration eight granite columns, surmounted by the entablature, still exist. The walls of the city were also renewed in solid bound masonry, and in the year 328 B. C., the lists of the Circus Maximus were built.

With few exceptions, none of the buildings previous to this time had any of the grand features of Grecian architecture. During the next centuries the principal works consisted of highways, bridges, and waterworks, and it was not until the 7th century of the city, about 50 B. C., that greater efforts were made in magnificent architecture. The buildings of the republic, down to that period, belong to five different classes, and we mention them accordingly.

1. TEMPLES. The piety which characterized the Romans of the earlier ages was still unabated in the present. Religious feeling was evinced on all occasions. Every victory or success in peaceable pursuits was attributed to the mercy of the gods; every defeat or failure to their wrath. Numerous vows were made and kept of erecting temples, partly from motives of gratitude, in part of atonement. When at a later date the philosophy of the

Greeks had become naturalized in Rome, the simple works of piety were superseded by the products of the love of splendor and of vanity in the times of Marius and Sylla, of Pompey and Julius Cæsar. In the year 301 B. C., Babulsus dedicated a temple to the goddess Salus, which was renowned for the pictures on its walls by Fabius Pictor, which were preserved to the time of the emperor Claudius. The temple of Bellona, erected 295 B. C., by Appius Claudius, was also renowned for beautiful paintings and sculptures. During the next three years were erected the temples of Jupiter Victor, Victoria, and Venus; the latter built by Fabius Gurges with the money collected from several matrons as fine for committing adultery.

In the year 290 B. C. the temple of Æsculapius was erected on the island of the Tiber. With a view to avert the calamity of the plague a ship had been sent to Epidaurus, which brought home the genius of this god in the shape of a serpent. In commemoration of this expedition the entire island was girdled with bound masonry in the shape of a ship; of this wall there are still ruins to be seen. The island was connected with the city by two bridges, the *Pons Fabricii* and *Pons Cestii*. *Pl.* 17, *fig.* 8, gives a sectional view of the island, with the temple and its portico as last rebuilt, the obelisk erected by Augustus (the top at *fig.* 8 *a*), and the two bridges. The temple of Æsculapius was of the Doric order, with 6 columns in front. The bridge of Fabricius (*fig.* 9, view; *fig.* 11, section), erected 62 B. C., by that consul, and rebuilt, 1680 A. D., by Pope Innocent XI., is 233 feet long, 20 feet wide, and consists of one large and two small arches of bound masonry. The bridge of Cestius (*fig.* 10, view; *fig.* 12, section), erected in the year 35 B. C., is 165 feet, by 30, and had two arches of 72 feet span, with three small arched openings in the piers. *Fig.* 13 exhibits a coin from the time of Antoninus Pius, representing part of the bridge of Cestius and of the buildings on the island. The foreground is occupied by the god of the river Tiber, and the symbol of Æsculapius, the serpent which was worshipped in his temple.

About this time Duilius and Attilius erected in the Forum Olitorium, near the theatre of Marcellus, three small temples, dedicated respectively to Pietas, Spes, and Janus. The first (*pl.* 15, *fig.* 16, plan) was a Doric peripteros; the second (*fig.* 18, plan) was of the Ionic order, with smooth columns on three sides and pilasters in the rear; and the temple of Janus (*fig.* 17, plan), which some archæologists attribute to Juno Matuta or Sospia, was an Ionic peripteros with two rows of columns both in front and rear. These three temples placed close together on an elevation of three steps show that the ancients sometimes grossly violated the laws of symmetry, the Doric temple being much smaller than the two Ionic, of which, again, the one on the right hand was smaller than that on the left. The details exhibit the same diversity both in appearance and proportions. The columns of the Doric temple were 2 feet, 4 inches thick, by a height of 7.65 diameters; the smooth columns of the smaller Ionic temple were 2 feet, 10 inches, 5 lines, and 9 diameters high; and the fluted columns of the larger Ionic temple were 3 feet thick, by a height of 9.21 diameters.

To this period belong also the temples of Tempestas, consecrated by

Caius Corn. Scipio; of Venus Erycina, by Fabius Maximus; of Concordia on the capitol; of Libertas on the Aventine hill; and a temple of Honor and Virtue at the Porta Capena, with two cellas, and decorated with many works of art which Marius had brought from Syracuse. This temple was of the Doric order, and had 6 columns in front and rear and 11 at the sides placed only at one diameter's distance from the walls. The temple of Hercules and the Muses in the Circus Flaminius, consecrated by Fulvius Nobilius, was decorated with the statues of the deities carried away from Greece.

The comparative smallness of the temples of Rome in this period is evinced by the circumstance that Fulvius Flaccus, 171 B. C., intending to erect a temple of Fortuna Equestris, which should be larger than any other temple in Rome, proposed to take for its roof *half* the marble tiles of the temple of Juno on the Lacinian promontory, but was refused them by the people.

Quintus Metellus was the first to favor magnificent architecture. With the booty of his victorious Macedonian campaign, 147 B. C., he erected a temple to Jupiter Stator, and one to Juno, the first temples of marble in Rome. They stood near together on a spacious place surrounded by a peribolus with a portico, which was later restored by Augustus, and is, therefore, sometimes quoted as the portico of Octavia, but oftener, and with more propriety, by its older name of Portico of Metellus. In illustration of these edifices we have given a front view of the portico (*pl.* 13, *fig.* 14), a ground plan of the entire group (*fig.* 15), and a plan of the temple of Jupiter a little larger (*pl.* 12, *fig.* 17). The portico, A (*pl.* 13, *fig.* 14), consists of two rows of fluted Corinthian columns, 36 feet, 6½ inches high, 3 feet, 4½ inches thick, and placed at distances of 1½ diameters. Each row consists of four columns and two pilasters, on which rests the gable. The front and rear pilasters are connected by walls containing the gates to the right and left colonnades which had a front of 10 columns each, the whole front being 100 feet. The temples of Jupiter and Juno were at C and D respectively, whilst in the rear was the school of Octavia. The interior of both temples was profusely ornamented with works of art by the greatest masters, among which were Praxiteles, Polycles, and Dionysius. The first structure which Metellus caused to be erected by the Grecian architects, Saurus (lizard) and Batrachos (frog), has Ionic columns; the restoration made under Augustus by the architect Hermodorus was of the Corinthian order. It is said that the first architects had worked without remuneration in the hope of being permitted to perpetuate their names by an inscription on the temple, but that this honor was refused them; when they introduced on the bases of the columns a sculptured lizard and frog in order thus to hand their names down to posterity. When the temples were completed and nothing remained but to erect the statues of Jupiter and Juno, these statues were misplaced by mistake, so that the temple with the statue of Jupiter was decorated with emblems relating to Juno, and that of Juno with emblems having reference to Jupiter. The mistake, being regarded as the will of the gods, was not rectified. The temple of Jupiter was a peripteros, that of Juno a pseudoperipteros.

Three columns of another temple of Jupiter Stator on the Forum Romanum are still in good preservation on what is now the Campo Vaccino or cattle market (*pl.* 14, *fig.* 1[13], view; *pl.* 19, *fig.* 12, capital; *fig.* 20, base). They are 4 feet, 5 inches, 9 lines in diameter, by a height of 45 feet, 3½ inches. Some archæologists deny the fact of there having been two temples of Jupiter Stator, and attribute these columns to a colonnade of Caligula which connected the Capitol and Palatine hills; others again call them remains of the temple of Castor and Pollux.

An important building of this period is the temple of Mars in the Circus Flaminius, which must not be confounded with that of Mars Ultor, erected at a later date by Augustus. Marius also, after his victory over the Cimbri and Teutons, erected another temple of Honor and Virtue, which was a peripteros without posticum, of beautiful proportions, but of poor material.

The temple of Jupiter Capitolinus was destroyed by fire, 137 B. C., probably the work of incendiaries, and Sylla immediately commenced rebuilding it, by order of the oracle, of the same form, but with the addition of the marble columns which he had brought from Athens, having taken them from the temple of Jupiter Olympius which was in course of construction by Pisistratus. He had the roof made of gilt bronze plates. Five years after the fire the new temple was consecrated by Lutatius Catulus, whose name shone on it until the second destruction by fire under Vespasian.

Pompey built in the Circus Maximus a temple near his own theatre, and dedicated it to Venus Victrix, whilst Julius Cæsar, during his third consulate, erected in his own forum a temple to Venus Genetrix, an offering which he had vowed before the battle of Pharsalia.

2. MARKETS, BASILICAS, CURIÆ. The public squares (*fora*) were of two kinds, such as served for meetings of the people for the transaction of the affairs of state, as the great *Forum Romanum* and the markets or sales places proper, as the *Forum Boarium* or cattle market, and the *Forum Olitarium*, or oil and vegetable market. Marcus Fulvius Nobilius caused a market to be erected outside the Porta Trigemina, which was surrounded by colonnades and served for the sale of the goods that arrived on the Tiber, and another between the cattle and vegetable markets which served as a market for fish and other provisions. The *Forum Julium*, built by Julius Cæsar, was much more important. It was built with the booty of the Gallic war, and about three millions of dollars were expended for the acquisition of private property alone to gain the necessary space. It contained, among other buildings, the above mentioned temple of Venus Genetrix and the Basilica Julia, uncompleted. Of the Forum Romanum as it is at present we have given a perspective view (*pl.* 14, *fig.* 1), which shows how few traces are left of its former splendor. The Forum is now called the Campo Vaccino, or cattle field. Of the objects which stand there the most important are: [1], The Triumphal Arch of Septimius Severus; [2], The Church of St. Adrian; [3], The Temple of Antoninus and Faustina (now the Church of St. Lorenzo); the Via Sacra, or Sacred

Way, is the centre of our view; [4], The Temple of Remus; [5], The Temple of Peace; [6], The Church of Santa Francesca; [7], The Temple of Venus and Rome; [8], The Coliseum; [9], The Triumphal Arch of Constantine; [10], Triumphal Arch of Titus; [11], The Farnesian Gardens; [12], Santa Maria, the Liberator, and opposite, the Temple of Castor and Pollux; [13], Temple of Jupiter Stator; [14], The Curia; [15], Temple of Romulus; [16], Temple of Fortune; [17], Temple of Jupiter Tonans; [18], The Column of Phocas; [19], Temple of Concord. We shall hereafter have an opportunity of speaking of most of these buildings.

United with the Forum was the *Curia*, where the Senate assembled. Upon the Roman Forum there was also one (*pl.* 14, *fig.* 1[14]) originating with Tullus Hostilius, and hence called Curia Hostilia. This curia was rebuilt by Sylla, but was burnt some years afterwards by the populace. M. Æmilius Lepidus demolished another building on the same spot, also bearing the name of Sylla, and Julius Cæsar built upon its site the Curia Julia, which, however, Augustus completed and adorned with fine works of art. Pompey built another curia outside the city and near his theatre; and it was here that the Senate met on the day that Cæsar was murdered and fell at the very feet of Pompey's statue.

According to Vitruvius, the Basilicas should also be placed upon the market-place. They served partly as courts of justice, partly as exchanges for merchants. The style of arrangement the Romans took from the Greeks. In Athens the building in which the archon sat in judgment, under the name of basileus or king, was called the stoa of the basileus, or briefly Basilica; hence the name. M. Porcius Cato was the first, who, 183 years B. C., began such a building. This Basilica Porcia lay near the curia of the great Forum, was burned with it 52 years B. C., and was never rebuilt. Fulvius Nobilior built the Basilica Fulvia, by the stalls of the money-changers, on whose site a much more magnificent building was afterwards erected. Besides these, there were also in Rome the Basilica Sempronia, built by Tiberius Sempronius, to make room for which the dwelling-house of Scipio Africanus was demolished; the Basilica Opimia, Basilica Æmilia, then the Regia, which Pompey built near his theatre. The finest, however, was the Basilica Pauli, which Æmilius Paulus erected upon the site of the Basilica Fulvia, with columns of Phrygian marble.

The basilicas claim our especial attention, because from them was derived the form of the Christian church. Thus the Basilica Fulvia or Pauli is now the church of St. Porcia, and the basilica of Sempronius is the church of St. George in Velabrum. The Roman basilicas formed a quadrangle, whose breadth was not more than the half, and not less than a third of the length, if the situation permitted. At the end of the length of the building, additions (*calcidica*) were built, in which were chambers where refreshments were served. Generally, the basilica stood upon the south side of the forum. The basilicas were distinguished from the hypæthral temples in this, that they had no exterior columns, but a covered vestibule in front, in the back of which shafts or pillars were placed. In the interior of such a building were two or four rows of columns, and in the rear an elevation or tribunal,

which was separated by a railing, and probably intended for the peculiar seat of the prætor. The columns, with the half columns against the walls, supported the roof in most basilicas. In some, however, there was a wall, pierced with windows, over the columns. The church of St. Paul outside the walls, St. Mary in Trastavere, St. Peter in Vincoli, give the best idea of the form and means of illumination of such basilicas. In front of the basilicas there were no porticoes reaching to the roof; and where columns were used, they were low, and formed the façade of the vestibule, which had no gable. There were often two tiers of columns in the basilicas, one over the other, with raised galleries.

3. Buildings for Public Amusement. At this period the buildings for public amusement were much enlarged. We reckon here the theatres, amphitheatres, the naumachia, and the circus. The plays were at first of religious origin; later they were regarded as methods of gaining popular favor, and became objects of the most extravagant expenditure and magnificence. The first play took place in Rome in the year 460 B. C., when, during a long, lingering pestilence, actors were summoned from Etruria to propitiate the gods. Earlier, there had been only combats in the circus. The actors amused the people with comical gestures and leaps, to the sound of flutes. Then verses were intermingled, and so gradually arose a kind of song-play, called Satyra. Livius Andronicus first connected the whole by a continuous story, which he caused to be sung with appropriate action, and hence arose the dialogue. Æmilius Lepidus built the first theatre, 178 years B. C., yet the sturdy Romans were so opposed to it that it was destroyed, as it was held unmanly to enjoy one's self in a sitting posture.

In the year 75 B. C. there was a convenient and even splendid theatre, erected with a velarium, or sun tent, to shield the spectators from the sun. The theatre which Scaurus, stepson of Sylla, erected 57 years B. C., seated 80,000 people. Curio, 48 years B. C., built two wooden theatres close together, which turned on pivots. During the day they were turned away from each other and plays were performed in both; then, with all the spectators they were turned together and formed one amphitheatre, in which combats took place. Modern mechanics will hardly credit this story; but so great was the zeal to win popular favor by something striking and wonderful, that in Pompey's theatre water was made to run down the aisles between the seats, in order to refresh spectators during the heat of summer. Behind the stage was a hall of columns to which the audience might retreat on occasion of a sudden shower. Julius Cæsar also began the construction of a huge amphitheatre of stone, which Augustus completed, and dedicated to the memory of his nephew Marcellus, son of his beloved sister Octavia. *Pl.* 14, *fig.* 2, represents the amphitheatre of Flavius, the coliseum, partly in section, and *fig.* 3 half the ground plan, with the ground level on the right, and the staircases upon the left. We shall presently return to this theatre.

The Naumachia were built like the amphitheatres, and contained so much water that ships could float and sail in them. Under the head of Naval Sciences we have spoken of these structures, and have there also represented such a Naumachia (Division VI. *pl.* 2, *fig.* 12).

The games of the circus were practised in Rome from the earliest times, and the great circus, in the time of Tarquin, was already an important building. The second structure of this kind was the Circus Flaminius, and then the circus of Flora, between the Quirinal and Pincian hills. The building received its essential alteration, however, in the great circus of Julius Cæsar. It was extended in length so that it was 3½ stadia long, and 400 feet broad. It was surrounded by a canal of water 10 feet deep. The lower story had stone; the upper, wooden seats. Three sides were appropriated to the spectators, of which it accommodated 150,000. The fourth contained the inclosures for the horses. In the historical division of this work we have treated of the circus games, and there also (Division IV., *pl.* 14) the reader will find illustrations of the various objects appertaining to it, with sketches of the elevation, ground plan, and section of the circus of Nero.

4. Sepulchral and Honorary Monuments. Monuments of honor were either porticoes, single pillars, or triumphal arches. The porticoes were not alone united with public buildings, but were often independent structures, and very agreeable resorts under the beautiful and burning sky of Italy. They were richly adorned, and statues, bas-reliefs, and paintings were placed in them. Garden retreats, groves, and fountains were often in the neighborhood. Even at this period there were many such buildings, but there were more under the emperors.

In the year 191 B.C., Æmilius Lepidus and Æmilius Paulus built two colonnades, one outside the gate Trigemina, on the Tiber, the other beyond the gate Fontinalis, towards the field of Mars (Campus Martius), as far as the altar of Mars. Cneius Octavius erected a famous double colonnade in honor of his triumph and the capture of Perseus in Samothrace. This colonnade, between the Flaminian circus and the theatre of Pompey, was magnificently restored by Augustus. The colonnade which Metellus Macedonicus built around the temple of Jupiter and Juno, is represented in elevation in *pl.* 13, *fig.* 14, and the ground plan after the restoration of Augustus, in *fig.* 15. Minutius, as proconsul, also built, from the booty of his victory over the Scordisci, a colonnade, which he named from himself, and which attracted attention even under the emperors. Q. Lutatius Catulus built one upon the Palatine hill, on occasion of his victory over the Cimbri, close by the house of Cicero, after whose banishment it was destroyed together with the house. Pompey also built a noble colonnade by his theatre, with garden walks.

Memorial columns are also of considerable antiquity. The first was the *Columna rostrata*, erected in honor of C. Duilius in the year 260 B.C., after his naval victory over the Carthaginians. (See Division VI., *pl.* 2, *fig.* 25.) It was of white marble. The people erected a column of Numidian marble, 20 feet high, to Julius Cæsar, with the inscription, "To the Father of his Country." A *columna rostrata*, with anchors, was erected to Octavianus Cæsar, in honor of his naval victories over Sextus Pompeius, on the summit of which stood the golden statue of the conqueror.

Triumphal arches were also honorary memorials. Upon these the statues of the victors were placed. Lucius Stertinius, in the year 195 B.C., erected

two such arches, with gilded statues, from the Spanish spoils, one upon the Forum Boarium, the other near the great circus. Six years afterwards, Scipio Africanus the elder built a similar one upon the Capitol; and Fabius Maximus, after his victory over the Allobrogi, the Fabian arch on the Via Sacra, near the old Regia. More frequent and more magnificent were these arches under the emperors, and under the head of the Empire we shall return to this subject.

Ancient as is the custom of sepulchral monuments, we shall here mention only the tomb of the Horatii, *pl.* 17, *fig.* 23[a], plan; *fig.* 23[b], elevation. This tomb is situated near Albano, and is called the Tomb of the Horatii and Curiatii, although some antiquarians reject the tradition, as it does not strictly harmonize with the historical descriptions, exhibiting truncated cones instead of pyramids. They refer the tomb to the last days of the republic. By this time, however, the use of splendid tombs was very common. They were erected upon all the great highways; yet very few remain except those at Pompeii. To these belongs the tomb of Scipio, which was situated upon the Appian Way by the Porta Capena; later, however, under Aurelius, it was included within the circuit of the city walls. In the year 1782, the subterranean portion was again disinterred. It seems to differ very little from that of the catacombs, of which we have given a description and a drawing in the historical part of this work. (See plates, Division IV., *pl.* 19, *fig.* 11.) The most important relic found in it was the sarcophagus of Scipio Barbatus, who was consul in the year 297 B. C. Upon this sarcophagus the oldest specimen of the Doric and Ionic order that we have in Rome is graved in relief. The most sumptuous, and in the important parts the best preserved tomb of this time, is that of Cecilia Metella, the wife of Crassus. It is situated on the Appian Way, and consists of a round tower, which is built upon a square substructure. The mass of the tower consists of little square quarry stones, and externally it is neatly covered with huge ashlers of travertine. Round the upper part runs a simple cornice moulding, and underneath a frieze, adorned with heads of bulls and clusters of fruit. Under that is the tablet with the inscription. An arched entrance opens into the interior, which is contracted conically and arched flatly, and contained a sarcophagus, which is now in the Farnese palace.

5. Bridges. The Romans, as we have already mentioned, were very good hydraulic architects, and their bridges, which have descended to our time, are remarkable not alone for their tasteful design and their fine style, but for the quality of the material and their careful and exemplary finish in the slightest details. We had already, in the description of the island of the Tiber and the temple of Æsculapius, opportunity of mentioning the two bridges of Fabricius and Cestius, and gave there (*pl.* 17, *figs.* 9–13) detailed drawings of them. To these we now add the bridge of Æmilius (*pl.* 17, *fig.* 14), at present known as the Ponte Molle. This bridge was also called Pons Sublicius, Pons Herculis, Pons Lepidi, Pons Sacer, and was the oldest originally wooden bridge of Rome, founded by Ancus Marcius, in the year 638 B. C. It led from the Aventine into the valley below the Janicu-

lum, and, falling into decay, was rebuilt of marble by the consul Æmilius Lepidus, 32 years B.C. One hundred years later, it was injured by the Tiber, and restored by Tiberius and by Antoninus Pius. But in the year 791 of the Christian era, it fell in entirely. Some of its piles are yet visible in the Tiber. *Fig.* 15 represents a part of the Bridge of Senators. It led from the Roman Forum towards the Janiculum, and was the first stone bridge in Rome. It was built in the 127th year of our era, by Marcus Fulvius Flaccus. It was 500 feet long, 40 feet broad, and was destroyed in the year 1598. Only three arches remain, known by the name of Ponte Sotto. Before its destruction it was called Ponte Santa Maria Egiziaca.

C. The Period of the Emperors.

The present epoch embraces the history of architecture in Rome under the Roman emperors, up to the decline of art under Constantine the Great. The theatre of art is now mainly Rome and Rome alone. Rome is its centre. The chief structures were erected, and whatever was done in the provinces received its impulse and reward from the emperor. So long as the empire was powerful, art maintained itself at the highest point. Its decline dates from the two Antonines, and then is more striking in the spiritual than physical regard. Colossal works yet arose, but no longer in the spirit of the epochs of Augustus, Trajan, and Hadrian. The technicality of art held its ground, but already the spirit was visibly declining. Of all the greatness of the Augustan age, nothing but the appearance remained in that of Constantine, and in nothing was decay so evident as in works of art.

We shall now proceed to mention the architectural enterprises of the various emperors, and begin with

1. Augustus. The battle of Actium, 31 years B. C., determined the universal dominion of Octavius Cæsar, who assumed, later, the name of Augustus. The Roman rule, enormously extended, could no longer exist as a republic. A series of civil struggles preceded the momentous change, and showed that weary mankind could rest and refresh itself only under the rule of one man. Augustus exercised with moderation the power that had fallen to him, and under him Rome enjoyed a repose and prosperity which were unknown to the earlier Romans. During his reign of 43 years peace was disturbed only at a distance, and there were few military troubles. Augustus improved this peace and his great resources to adorn the metropolis, encouraging all his friends to a similar occupation.

We have already mentioned the buildings erected before the empire by Augustus and his friend M. Agrippa, his son-in-law and heir.

When Octavianus Cæsar returned victorious from Egypt, 30 years B. C., the senate and the people erected to him a gate of honor at Brundusium, where he landed, and a second upon the Roman forum. A year afterwards he dedicated the Curia Julia and the temple (the Heroon) of Julius Cæsar. Some hold the columns yet standing upon the Forum, which we, with others, have attributed to the temple of Jupiter Stator, to be the remains of this temple. Besides the Curia Julia the unfinished Basilica Julia was

completed by Augustus, and as it was soon afterwards again destroyed by fire, it was once more rebuilt and adorned with a chalcidicum. After Augustus had erected a temple to Apollo upon the Palatine, inclosing a Greek and Latin library, and a wooden stadium upon the field of Mars in the Grecian style, he commenced the restoration of the old, falling temples; of these restorations, if we may credit the Ancyranian inscription, there were not less than eighty-two.

In the same year that Augustus built the stately temple of Apollo upon the Palatine, he laid the foundation of a mausoleum for himself and his family. It was built in the shape of a hill, upon a foundation of white marble, covered with evergreen trees, and upon the summit stood the statue of the emperor. In the interior of this artificial hill were compartments and chambers intended as burial-places for the household. The innermost of the four circular walls of which the skeleton of the building was formed, as in the gardens of Semiramis, is fallen, thereby discovering a round space large enough to form a ring for modern bull-fights. Before the building was a kind of propylæum, in which hung brazen tablets inscribed with the memorabilia of the emperor. These tablets have disappeared, but a copy of them is preserved in Ancyra in Asia, which we have just mentioned as the Ancyranian inscription. In the year 21 B. C. also took place the dedication of the Temple of Jupiter Tonans, of which we have already spoken, and which was raised upon the spot where the lightning struck a slave who was bearing a light before the emperor.

The three remaining columns of this temple belong to the portico; but they are too much laden with ornament for the Augustan age, and the remaining letters on the frieze, E S T I T U E R, belong to the word *restituerunt*, and indicate a reconstruction of the temple under Septimius-Severus, who always joined his son's name with his own, and hence the plural *restituerunt*.

In the year 15 B. C. Augustus commenced one of his chief undertakings, the temple of Quirinus upon the Quirinal. It had 76 Doric columns, and as Augustus died afterwards in his 76th year it gave rise to a superstitious feeling in connexion with it. Yet a Doric dipteros having 8 columns in front and 15 in length, required this number of pillars, and was consequently symmetrical, as our ground plan shows (*pl.* 15, *fig.* 9). In the year 12 B. C. Augustus dedicated the theatre commenced by Julius Cæsar, but only then completed, and which he called, in honor of the dead son of his sister Octavia, the theatre of Marcellus, of which there are still important remains. The theatre contained 30,000 seats, and was consequently somewhat smaller than that of Pompey, which held 40,000 spectators. In this theatre the use of the dental ornament in the Doric entablature is remarkable, and does not occur before. The diameter of the orchestra is 180 feet, 4 inches, and the height of the wall 98 feet, 10 inches. Here are also the Doric half columns which gave the suggestion for the Doric order of Vignola and Daviler (*pl.* 23, *fig.* 2). Of the remains of the porch of Octavia, founded by Augustus (for the protection, possibly, of the spectators in the neighboring theatre of Marcellus from the rain), we have already spoken (p. 62).

Augustus erected also two obelisks, which he had ordered to be brought from Heliopolis in Egypt in the year 9 B. C.; the one consecrated to the sun and Osiris, in the Circus Maximus, in the midst of the spina, and the other, executed under Sesostris, upon the Campus Martius. The mathematician Manilius put them up, and as the obelisk of Sesostris was to serve as a dial-plate, a stone pavement was laid around it, upon which the shadow was indicated. Both obelisks still stand. Pope Sixtus V. took the one from the circus and erected it upon the Piazza del Popolo. Pope Pius VI. directed the architect Antinori to erect that from the Campus Martius upon Monte Citorio. The hieroglyphics upon the first have been deciphered by the famous archæologist Professor Seyfarth of Leipsic.

To the greater and more splendid works of Augustus belongs the forum named from him, with the temple of Mars the Avenger which he built upon it, but which must not be confounded with a kind of chapel to Mars the Avenger which Augustus built upon the Capitoline hill, and in which the Parthian trophies were deposited. We give a ground plan of this hypæthral temple (*pl.* 13, *fig.* 7), of which 3 beautiful columns yet remain on the right wing. Their diameter is 5 feet, 6 inches, but the leaves in the capital have too little projection. A pilaster with convex capitals, some remains of masonry of the roof, and the cornice, of which, however, the moulding is gone, have come down to us.

Among the restorations of Augustus we must mention the temple of the Capitoline Divinities, the theatre of Pompey, the Lupercal (shrine of Pan), the temples of the Lares, of Minerva, of Juno Regina, and the vestibule of the goddess Liberty upon the Aventine, as well as a great number of larger or smaller water-works, naumachia, &c., &c.

Augustus not only adorned Rome with beautiful buildings himself, but he exhorted his friends to do the same. Among the most important of those which rose from his example and exhortation are the Septa Julia, built by Menenius Agrippa, in which the popular assemblies according to races were held; the porch of Neptune, in commemoration of naval triumphs; the Baths, and the Pantheon.

The *Pantheon*, the most beautiful building in Rome, throwing out what was added subsequently to Augustus, is the finest and best preserved monument of antiquity in the world. It was built under the republic, without the exquisite portico, which was added by Augustus and Agrippa. *Pl.* 17, *fig.* 4, gives the view of the building deprived of its later and injurious additions; *fig.* 5, the lateral section; *fig.* 6, the inner perspective; *fig.* 7, the ground plan. *Pl.* 19, *fig.* 13, is the representation of a capital from the portico, and *fig.* 21, a base from the portico. Agrippa dedicated this temple to all the gods, especially, however, to Jupiter Ultor and Cybele. Afterwards the portico was injured by lightning, but was restored under Severus and Marcus Aurelius. Pope Boniface IV. consecrated the temple as a Christian church. Urban VIII. elevated some columns that had fallen, but, alas! took away the beautiful bronze ornaments, and melted them into cannon, and into the tasteless altar of St. Peter's; and at last the two execrable towers were built upon the roof by

Bernini. Clement IX. disfigured the portico by the railing, 14 feet high, between the columns.

The chief building of the Pantheon forms a complete circle, whose diameter is 153 feet, and 133 feet in the clear. The exterior has three grand divisions, with freestone cornices. The foundation is of white marble, the rest of the building is brick. Upon the chief wall rests the dome, covered with lead, and on the outside diminishing stepwise towards the apex. The height of the steps is 27 feet. The dome has at top a round opening 37½ feet wide, with a bronze cornice, the means of illumination of the interior. The original façade, before the portico was built, had 4 pillars, upon which rested a great gable, which is now partly concealed by the gable of the portico. The colonnade added by Agrippa consists of 16 smooth Corinthian columns 44 feet, 1 inch in height. Eight of them stand in the front row (*pl.* 17, *fig.* 7). The corner columns are 4 feet, 8 inches in diameter, the middle 4 feet, 6 inches. The shafts of the columns are sculptured of a single block of granite; the capitals, bases, and the cornices are of white marble. The sides of the front and rear gables run parallel, and the cornice of the gable fields rests on consoles. The tympanum had sculptures, probably in bronze relief. Under the portico in the middle is the single door of the Pantheon. There is a bronze grating in the upper part of the door to admit light into the interior of the edifice. There are bronze rosettes in the little panels of the door. On its side are two large niches built of brick covered with stucco, as high as the door (36 feet, 1½ inches), in which formerly stood the statues of Augustus and Agrippa. The latter is now in the palace Giustiniani in Venice. Agrippa's ashes lay in a fine sarcophagus which stood afterwards in one of the niches. It now contains the body of Pope Clement XII., and stands in the church of St. John Lateran.

The height of the interior of the Pantheon is equal to its diameter. There are two great side arches, supported upon 4 of the 14 columns which support the main cornice. One of these arches is in the further end, and under it once stood the statue of Jupiter; the other springs over the entrance. Besides these there are smaller chapels in the circumference of the interior; two form semicircles, the rest long quadrangles. Every chapel has pilasters upon the side, before which stand Corinthian columns wrought of yellow-veined marble, 3 feet, 4 inches in diameter, and 32 feet, 5½ inches high. The shafts are each sculptured out of a single block, and the flutings are filled below with beads. Between the chapels stand eight altars. Each altar is formed of 2 little Corinthian columns 4½ inches through with their entablature, cut in the style of the order which is still visible on the arch of Constantine, with a gable over it. The gables are alternately semicircular and triangular, the whole apparently imitated from the niches of the temples of Palmyra. The columns, partly of marble, partly of porphyry, partly of polished granite, stand upon high plinths. Behind each altar in the wall are empty semicircular chambers, which are repeated at every story. Doors lead to the lower ones, steps to the middle, doors again to the upper. These chambers serve for the saving of masonry, for the drying and

airing of the walls, and for the diminishing of the pressure upon the foundation. The inside of the walls is covered entirely with marble. One half of the height consists of the dome and the other of the vertical wall, constructed partly of brick vaults, and forming arches over the architrave of the lower columns.

In the interior there are two dissimilar divisions; the under part consists of the columns above described and of the arches that interrupt their entablature. The upper part is a kind of upper story in which 14 openings, with handsome mouldings, are pierced, which let the side light fall upon the niches beneath. To interrupt the flatness of the surface there were formerly pilasters of porphyry, serpentine, and yellow marble placed against it, which were removed by order of Pope Benedict XIV. and replaced by paintings.

The cupola contains 4 rows of 28 deep panels, upon whose ground there were formerly bronze rosettes which Constantine II. despatched with several statues to Constantinople. But the ship was wrecked. In order to carry off the rain that enters through the opening in the dome, the floor, which is a mosaic of marble and other stones, inclines towards the centre where there is an escape for the water, which flows into a branch of the Cloaca Maxima and thence to the Tiber. When the Tiber rises, however, the floor of the Pantheon is overflowed by the inundation.

Formerly the entablature of the portico was of brass, and the whole building was covered with gilded bronze plates in the form of tiles. Urban VIII., however, replaced the bronze beams with wood and the tiles with a leaden roof, and melted the metal, as we have already stated. The baths of Agrippa were situated immediately behind the Pantheon, and *pl.* 17, *fig.* 7, shows a part of its ground plan. The ground plan of a Rotunda on the Appian way and that of one on the Via Prænestina, are precisely like that of the Pantheon, although on a much smaller scale (*pl.* 13, *fig.* 11).

Among the other important buildings of Agrippa were a great aqueduct, the colonnades of Europa, and the Diribitorium, which, however, he did not complete. The latter building was used as a place of popular assembly at elections, for the distribution of alms to the needy citizens and of pay to the soldiers, and was the largest building ever included under one roof, for it had beams of 100 feet in length and 1½ feet in thickness. When the building fell into decay, no one would undertake its reconstruction.

Besides Agrippa, other friends of Augustus distinguished themselves by their buildings: Statilius Taurus, who built an amphitheatre, then the only one in Rome; Marcius Philippus, who restored the temple of Hercules and the Muses; Cornificius, who erected a temple to Diana; Asinius Pollio, who founded the first public library in Rome, in the hall of freedom built by him; Munatius Plancus, who restored the temple of Saturn, the treasury of Rome; and Balbus, who built a stone theatre upon the Campus Martius. Among these, too, must be named Tiberius, afterwards Emperor. He restored the temple of Castor and Pollux, and the temple of Concordia originally erected by Furius Camillus. This temple (*pl.* 13, *fig.* 4, elevation; *fig.* 5, plan), stood with its back to the Roman Forum, and near the temple of Jupiter Tonans, of which three columns yet remain.

It was a prostylos with six Corinthian granite columns, with marble capitals and bases; and there were two windows and a door on the long side. Altogether the ground plan of this temple indicates a very peculiar construction and different from all hitherto in use.

To this time, also, belongs the building of the renowned pyramid of Cestius, and the so called Temple of Honor and Virtue above the fountain of Egeria, and termed by some also a temple of Bacchus and the Muses. *Pl.* 15, *fig.* 12, shows the elevation, and *fig.* 13 the longitudinal section of this temple, which is now the Church of St. Urban alla Caffarella. This structure has in front 4 columns, separated from each other by the space of 3½ diameters. They are of the Corinthian style, with imperfect capitals, 2 feet 4 inches in diameter, 22 feet high, supporting a miserable brick wall with a gable at the top. The portico is now walled up, and arranged with windows and buttresses. The ceiling of the interior is a cylindrical vault, covered with stucco and disposed in octagonal panels. It rests upon a finely ornamented frieze, and the brick walls of the inside are divided by pilasters. For the rest, it seems as if the temple, as it now stands, had been built of ancient materials, but was not itself of ancient times.

Thus far we have only considered the architecture of the period in the city. We turn now to the works outside the city.

First we refer to Tivoli, the charm of whose landscape made it much sought as a country retreat. Here were the country seats of the illustrious Romans, and there yet exist considerable traces of the villa of Mæcenas. Quinctilius Varro, too, had here a villa of which some foundation walls and vaults yet remain. Here were the villas of Horace and Propertius, and there are relics of the superb country house of Plautius still to be seen. In the town itself there are two temples built next each other above the falls of the river Anio. The one is a round peripteros of which the greater number of columns, and the walls of the cella, with the door and one of the windows, as well as the substructure, remain. This temple is supposed to have been sacred to Vesta, and *pl.* 16, *figs.* 9 and 11, give general views of it. *Fig.* 10 gives a section, and *fig.* 12 the ground plan. It is in the Corinthian style, and the columns, whose bases are seen in *pl.* 19, *fig.* 19, are of travertine covered with stucco. The cella is built of volcanic stone in irregular work (*opus incertum*, p. 24). The other standing by it is a little prostylos pseudoperipteros in the Ionic style, and is regarded as a temple of the Tiburtine Sybil, contemporaneous in structure with the other. *Pl.* 16, *fig.* 38, gives its ground plan. Of the great temple of the Tiber, consecrated to Hercules, and in whose halls Augustus often sat in judgment, there are some remains in the chief church of the town. Of the antiquities of Præneste there are only a few remains of the Forum and of the basilica belonging to it.

In Cori, the old Cora, an ancient mountain town in Latium, there are the remains of two temples besides those of the Cyclopean walls. Of the one dedicated to the Dioscuri there yet exist two remarkable Corinthian columns; of the other, known under the name of the Temple of Hercules,

of which we have given the ground plan, *pl.* 16, *fig.* 24, the columns of the portico, with the entablature and the door, and a part of the cella, are yet visible. The style is Doric, but its rules are not sufficiently followed to allow the temple to be quoted as a good example of that style.

In Pozzuoli the chief church is built upon the ruins of a temple of which several Corinthian columns remain. Near the city there are also the ruins of a round temple which was a monopteros, and dedicated to Jupiter Serapis. *Pl.* 13, *fig.* 99, shows the ground plan. The bases of the 16 pillars of the temple are yet standing, and three of the so called Cipollino marble columns of the quadrangular peribolus which surrounded the temple. There are also at Gaeta the ruins of the monument of Munatius Plancus, and at Naples the Tomb of Virgil and ruins of the temple of the Dioscuri.

Turning towards upper Italy we find besides the ruins of the bridges and of the arch of Augustus at Norni, a beautiful temple of Minerva in Assisi, now the church Maria della Minerva. It is a six columned prostylos of the Corinthian style, of which *pl.* 16, *fig.* 21, gives the ground plan. In Fano, the old Finestri, Vitruvius built a characteristic basilica, of which unhappily there are no remains, and which cannot be drawn after his description (*lib.* v. *cap.* 1), although Barbaro, Canina, Marini, and others have attempted it.

In Nismes, a provincial town of Augustus, there is, among other remains, a well preserved temple, dedicated by Augustus to the two sons of M. Agrippa, Caius and Lucius. This temple, of which *pl.* 15, *fig.* 10, gives a general view, and *fig.* 11 the ground plan, is a prostylos pseudoperipteros, with six columns in front and half columns around the cella. The building is very handsome, of the Corinthian style, and now known under the name *Maison Quarrée*. At the foot of the Alps, near Torbia, there is the nucleus of a monument which was dedicated to Augustus, and known as the Trophæon of Augustus. From Pliny's description, Canina undertook its restoration, of which *pl.* 18, *fig.* 8, gives the elevation, and *fig.* 9, the ground plan.

By means of Roman conquests a better knowledge of art began now to diffuse itself over the countries adjacent to the Danube and the Rhine. Formerly those lands had neither cities nor boroughs. Each family lived alone on its own premises, and building with brick or quarried stone was equally unknown. Under Augustus, however, things assumed another aspect, and cities and villages arose along the Danube and the Rhine, and many important hydraulic works were undertaken. It is uncertain how far the limits of the Romans extended beyond the Rhine, and what was the precise direction of the stake-ditches that separated the Roman possessions from free Germany. Probably Nuremberg lay within the line, for its castle tower seems to be altogether Roman. Many cities, especially smaller ones, such as Rottweil and Villingen, indicate in their plans the form of the Roman camp with remains of towers and walls. Of Roman buildings, however, there are very few except at Treves and the Baths of Badenweiler; yet recently many more have been brought to light.

Further down the Danube two triumphal arches were erected in honor of Tiberius, remains of one of which exist at St. Petronell in lower Austria At Pola in Istria there are, among other remains of which we shall hereafter speak, those of a temple, of which *pl.* 16, *fig.* 25, gives the ground plan. It was a prostylos of the Corinthian order with plain columns, and, according to the inscription upon the architrave, dedicated to the goddess Roma, and to Augustus. The columns are 2 feet, 7½ inches diameter, and 27 feet, 5 inches high.

2. Tiberius. As long as Augustus lived and Livia had some influence upon the dark mind of her son, he did not show himself indifferent to the higher aims of art. As ruler, however, he completed no fine building in Rome; and the single one which he undertook, the Temple of Augustus, he left uncompleted during his reign of 25 years, so that it was only first dedicated under Caligula. On the other hand he completed many restorations commenced by Augustus, or of buildings which had been burned. In the year 23 B. C., Tiberius, at the instigation of Sejanus, caused the Pretorian Camp to be built for the Body Guard, which measure, by the tumultuous spirit of the Pretorians inclining them constantly to revolt, proved dangerous to the Emperors. There exist some remains of this structure which Constantine destroyed. Among the buildings outside Rome we mention only the unfortunate theatre at Fidenæ near Rome. The architect Attilius, a freedman, had undertaken to build a wooden theatre in which spectacles should be exhibited for money. The Theatre fell during a representation, and injured 30,000 men, of whom, according to Suetonius, 20,000 died.

3. Caligula. The reign of this emperor was very short, but much too long for the happiness of mankind. Little was accomplished in building, for the extravagant plans of the emperor were left half finished. Under him, however, the temple of Augustus, commenced by Tiberius in Rome, was completed, and the restoration of the theatre of Pompey. The Palatine house, the usual residence of the emperors, was extended to the great Forum, so that the temple of Castor and Pollux formed the vestibule. *Pl.* 11, *fig.* 7, gives the general view, *fig.* 8, the ground plan of this temple. It was of the Corinthian order, and had 8 granite columns in front and 13 on the sides. The arrangement of the portico and of the pronaos is peculiar. In this temple, placing himself between the heavenly twins, the emperor received divine honors as Jupiter Latiaris. He built an especial temple to his own divinity, in which stood his statue, which was daily clothed as the emperor was dressed that day.

He commenced also a great aqueduct, which was afterwards completed by Claudius. The building of an amphitheatre upon the Campus Martius was soon relinquished. He began to build a circus upon the Vatican. He proposed to restore the temple of Apollo Didymæus at Miletus, and to cut through the isthmus of Corinth; but these plans were no more realized than that of building a city upon the highest pass of the Alps.

4. Claudius. The buildings of this emperor are more distinguished for their

size and usefulness than for their number. Among them the Port of Ostia, the draining of the Fucinian lake, and the completion of the aqueduct commenced by Caligula, are to be mentioned. The building of the harbor of Ostia was, even at that time of enormous expenditures, one of the most enormous. A huge basin was hollowed out of the solid earth and surrounded by a wall of freestone. This was connected by a canal with the sea and with the Tiber, and at last an outer harbor was built into the sea by means of two piers. In order to protect the harbor from the sand and the piers from the waves, an artificial island was built, a large vessel loaded with sand and stone being sunk in the sea. Upon this island a lighthouse was erected. At this time, the temple of Jupiter Patulcius of Ostia, which had been struck by lightning in the year 200 B. C., was restored. *Pl.* 16, *fig.* 20, gives the ground plan of this temple, of which there are very few remains; sufficient, however, to show that it was of the Corinthian order and very richly ornamented. The cornice is remarkable, and in the interior the cella had Corinthian pilasters with very ornate capitals. The aqueduct, mentioned before, was 184 miles long, 144 of which were subterranean. This was united in the neighborhood of Rome with a second, 248 miles long, partly subterraneous, partly resting upon arches and substructures, leading from the Anio, whose troubled waters were first clarified in a peculiar reservoir. The united aqueduct extended then upon arches, some 109 feet in height, to the walls of Rome. 30,000 nen labored for 11 years upon the draining of the Fucinian lake, and it w is designed to use the area of the lake for cultivation. When the canal was ended, a great naval battle took place upon the lake. Then the Emperor and the people repaired to a great banquet held upon a scaffolding erected in the lake. The sluices were opened, and before the banquet was ended the lake was drained After-wards the sluices became stopped up by neglect, and the lake exists at the present day as under Claudius, but it would cost scarcely half a million to restore the old work completely. In the reign of Claudius also, that the soldiers might not be idle, they dug a canal 92 miles long between the Meuse and the Rhine.

5. Nero. Under this emperor the art of building was carried to a point hitherto unattained, yet posterity can show no traces of the works of this emperor. His first building was a wooden amphitheatre upon the Campus Martius, and in the year 62 A. D. the emperor erected the gymnasium called after him, and the adjacent baths, now more generally known as the Alexandrinian baths, as Alexander Severus restored them. Never, however, was the zeal for building so intense as with Nero, who, in order to obtain the space adequate to his house, and at the same time to rebuild the city more magnificently, caused it to be set on fire. Of the 14 districts of the city three were entirely destroyed, and seven were more or less injured. The fire raged nine days, and immense pecuniary loss as well as the destruction of treasures of art was the consequence. For the rebuilding the emperor removed the rubbish, and made ample indemnification, but introduced a very severe building law. The rubbish was devoted to filling up the swamps of Ostia; and Monte Testaccio, which yet remains, is a rubbish

hill of this period. The ships in port were obliged to load with the rubbish as a return freight. To this period also belongs the beginning of the so-called golden house of Nero, of which Severus and Celer were the architect and builder. It is difficult to form a just idea of the magnificence of this house, which embraced corn fields, meadows, vineyards, forests, and fish ponds, and in which stood the colossal iron statue of Nero 120 feet high. The interior of the building glowed with gold and precious stones, and there were banqueting halls, with ivory tables wound with flowers, and with ceilings pierced like sieves, in order to shower odors upon the guests. When Nero dedicated the completed house he said, "That he had at length a home fit for a human being to live in." The statuary Zenodorus cast the colossus of Nero.

With Nero ended the Augustan family, and the emperors Galba, Otho, and Vitellius reigned too short a time to complete any important works. So much the more, however, was accomplished under the three next emperors of the family of Flavius.

6. Vespasian. The first great undertaking of this emperor in building was the often-projected re-construction of the temple of Jupiter Capitolinus, which was once more burned, and this time in the struggles of the followers of Vitellius with those of Flavius. Vespasian commenced the work with great zeal. He put his own hand to the work, in order to encourage the laborers, and the corner-stone was laid with great pomp. For the rest, according to the decrees of the augurs the new temple should in no manner differ from the old, except in the little greater height of the columns. But the building was not destined to remain a long time, for it was again burned under Titus, and, as we shall presently see, was rebuilt by Domitian. The golden house of Nero was for the greater part destroyed, and the remainder much changed. A second important building was the temple of Peace, whose form, however, differed materially from that formerly in use. According to the remains it was long in form, with a wide nave in the middle supported by eight Corinthian marble columns 5 feet, 8 inches, 3 lines in thickness, and about 57 feet, 11 inches high. At the sides were three deep spaces like chapels, and in the front-wall of the great aisle was the large niche for the temple statue. The temple, besides its chief entrance from the Coliseum, had also a side passage towards the modern street. We find more of the basilica form in this temple, and to such an extent, that these remains are sometimes called the Basilica of Constantine, which however they are not. A very beautiful architrave soffit of this temple is given in *pl.* 19, *fig.* 27. Bramante, in his first plan of St. Peter's, placed the Pantheon upon the Temple of Peace.

In the interior of this temple rare works of art, and valuable objects of all kinds, even the state treasury and the money of private individuals were kept, so that when it was burned in the time of Commodus the loss was incalculable. One of the colossal columns yet remains, and stands upon the place Santa Maria Maggiore. The height of the temple from the floor to the top of the arch was 112 feet, and this is probably the first instance of the great cross arch. This temple is also called the Temple of the Cæsars, from which we represent a capital (*fig.* 11).

In the year 72 A. D. Vespasian began the colossal amphitheatre of Flavian, known by the name of the Coliseum, of which we have given a general view and section in *pl.* 14, *fig.* 2, and in *fig.* 3, the half ground plan. The building was completed by Titus, and occupied only a few years. The ground shape of this theatre is elliptical. The longer diameter is more than 600 feet, the shorter more than 500. Eighty small arcades on the circumference led to two galleries on the ground floor, parallel with the outer circumference. The public passed by 24 passages which led to the first places, into two other concentric galleries, before which were the podia for the senators, vestals, ambassadors, &c. and behind which were the seats for the knights. These places occupied the first twelve rows of seats, and those of the knights the next 17. The populace ascended to the third story upon the numerous staircases of the various galleries, and in the fourth or highest story sat the freedmen, servants, and women of pleasure. They reached their places by a staircase over the arches of the gallery of the second story. There were broad entrances from the sides and ends of the area to the first places, and to the box of the emperor, which was distinguished by an elaborate projection. The arrangements for seats formed a ring of 60 feet in thickness, and provided accommodation for 87,000 people. The area left in the centre served for the combats of beasts and gladiators, &c. The exterior ornament consisted of three tiers of 80 arcades, the first Doric, the second Ionic, the third Corinthian. The upper story formed an attic with Corinthian pilasters and 40 windows. Between every two pilasters were three consoles, consequently 240 in all, each one of which bore a bronze support which passed through the cornice, and which altogether held the pulleys upon which the velarium was drawn. In the various arcades stood statues, chariots, &c. *Plate* 14 *fig.* 4, shows a section of the amphitheatre at Verona, and *fig.* 5 that of the amphitheatre of Nismes, from a comparison with which it will be seen how gigantic a building the Coliseum was. The amphitheatre of Nismes, which was oval, was somewhat over 400 feet in length, and over 300 feet in breadth.

Besides architectural works Vespasian did much for the highways, and the Flaminian way, which embraces an archway through the rock Petra pertusa (Pierre pertuis of modern times) 1000 feet long, was completed the year of his death.

7. Titus. During the reign of this emperor more was destroyed than was rebuilt. For, in the 79th year of our era, occurred the memorable eruption of Vesuvius, which laid waste the surrounding country, and shook the entire city, and shortly after a fire broke out in Rome that destroyed the finest and fairest part of the city, the buildings of Nero in the Campus Martius, the Temple of Isis, the Baths, &c., and also injured the Pantheon, and the Porch of Octavia. It was not until his successor that the loss was replaced.

As the destruction of the Campanian cities occurred in the reign of Titus, this seems the proper place to speak of the present condition of the excavated towns of Pompeii, Herculaneum, and Stabiæ. Of the last very little has been hitherto discovered. In Herculaneum the excavation was undertaken with

zeal and diligence, and the result was the discovery of a great mass of antiquities of all kinds. But as the city was buried under a great accumulation of lava and a new city was built over it, the work could only advance as in a mine, by shafts, and for this reason the work is nearly discontinued, because it required a disproportionate sum of money to forward it. The theatre has been entirely laid bare, and it is evident from that that Herculaneum was by no means a little provincial town. This theatre offers the best study of the theatre-building of the ancients.

The excavation of Pompeii was much easier and more convenient, for there was no overflow of lava here, and the town lies buried only under ashes and little stones, a few feet beneath a vineyard. Here buildings, streets, and places have been restored to the light, and therefore all available funds are devoted to the excavation, which constantly progresses with more or less diligence, so that a very tolerable conception of the structure and arrangement of an ancient city is now possible. The town, although not small, was only a provincial town of the third degree, but had all the buildings necessary to the business and amusement of a city, except that they are on a smaller scale than those of which we find traces in the large cities. The private houses also are lower and smaller than in a great town. They are of one story only, and evidently adapted to a single family. Only a very few of the recovered houses have two stories arranged with terraces.

A wanderer through the city discovers many buildings, chiefly public buildings, which at the time of the volcanic eruption were in process of building, and Tacitus relates that Pompeii was almost destroyed by an earthquake a little before its final catastrophe. According to Seneca, this event preceded the final one by sixteen years, and hence we find most of the private houses restored, but with only one story to provide against similar misfortunes. The rebuilding of the public edifices progressed more slowly, yet the amphitheatre was entirely completed, although the other theatres and the forum with its adjacent buildings were not so. Few of the streets are broad enough to allow the passage of a carriage, but they are well paved, and have elevated side walks. At the corners of the streets are fountains. Quite as carefully paved and provided with side walks are the streets outside the city, and upon these streets were the family sepulchral monuments. We have treated of the city walls of Pompeii, illustrating them in detail under the head of Military Sciences (Fortification); see Plates, Division V., *pl.* 43, *figs.* 10–15. The sole remaining gate has three entrances; the middle one for carriages, and one on each side for foot passengers.

The dwelling houses are built together, but without communication with each other, and the main walls in common. Upon entering you pass into a court, small or large, generally surrounded by a colonnade, and with the sleeping rooms, sitting rooms, and kitchen opening upon it. It is all small but tasteful, with pavements of marble and mosaic. The walls and columns are covered with a coating of chalk and marble dust, smooth as glass, with a surface colored in fresco, upon which are laid the water colors. When treating of the Fine Arts we shall return to these wall paintings. In two bakeries the ovens are yet standing; they were heated from below.

Of the public buildings the amphitheatre is the most striking. It could easily accommodate 12,000 men, and the rows of seats are made of volcanic tufa. Of the two theatres that lay near each other, one was covered and served as an odeon; the large one was in process of building. The steps of white marble were not all placed, and the wall work of the stage was not yet plastered. The forum was in the same incomplete state, and was to have had two colonnades one above the other. The pedestals of the statues, the equestrian also, were ready, but there were no statues. On the long side of the forum were three small buildings almost like basilicas, destined for the sessions of the municipality. On the opposite side was the curia with the archives, and a kind of pulpit standing in the open air. Here also was the comitium, where the magisterial electoral assemblies were held.

The administration of public affairs must not go on without the close superintendence of the gods, and hence there was no want of temples in the vicinity of the forum. In the neighborhood, and only separated by the street from the comitium, lay a long court surrounded with walls, on the side of which ran a colonnade. In the midst of the court upon a lofty flight of steps a small temple, whose ground plan, *pl.* 16, *fig.* 37, shows that it was a prostylos hypæthros. This temple was dedicated to Jupiter, as the fragment of a very beautiful statue of Jupiter found in the vicinity leads us to suspect. Before the temple stands a large sacrificial altar. This temple was not fully restored, yet there were beautiful paintings on the wall. Upon the opposite side of the forum were two small temples, one dedicated to Venus, the other to Fortuna. Both were of the Corinthian order, and we give the ground plan of the temple of Fortuna, *pl.* 16, *fig.* 28. Near the forum was the hospital of Augustus, in the court of which was a round or rather polygonal monopteros dedicated to Augustus. *Pl.* 13, *fig.* 10, shows the ground plan of this little temple. We must finally mention three temples, or rather chapels, which stood tolerably near one of the long sides of the forum. The most important is the temple of Æsculapius (*pl.* 16, *fig.* 31, shows the ground plan), which is hemmed in by other buildings, but has a porch with two columns towards the street. The temple itself is a Doric prostylos with four columns in front, and a fine sacrificial altar stands before it. The chapel of Isis (*fig.* 30) stands with the long side towards the street, from which it is separated by the walls of the porch. A colonnade of the Doric order surrounds the porch, in the corner of which stands a little building destined for the use of those who had charge of the temple, and who took care that no improper person penetrated to the mysteries of the goddess. Others suppose this small building to have been designed for beasts, as was the custom in all Egyptian temples. Here the Ibis might have been kept, a bird sacred to Isis. This bird is an important figure in two paintings representing the religious habits of the Egyptians, which were taken from the walls of this temple of Isis. The sacrificial offerings might have been kept there, which were brought and consumed upon the platform by the ibis, and with which a kind of augury was connected. In the court itself there were several altars, and the temple is a prostylos of four columns, and the middle space between the columns is the largest, as

thence the staircase led to the upper part of the building. The temple has an opisthodomos in the interior, and two wings with paintings.

The chapel of Mercury (*fig.* 29) forms no rectangle, as the street runs slantingly against the long side, and the short sides are parallel with the street. The temple itself has a fore-court inclosed by walls adorned with pilasters and a colonnade in front, and is a Corinthian prostylos with four columns, standing upon a high substructure accessible from the rear. In the court stands a large sacrificial altar. The columns of all the temples hitherto mentioned are fluted and very tastefully adorned.

To this brief survey of the ancient buildings in Pompeii, we add some general remarks upon the style there prevalent. In technical architecture there is little worthy of note. The walls, even of the largest buildings, are mostly of quarry stone, seldom of brick, and scarcely at all of freestone. Often the columns are of mason work, sometimes of great blocks of limestone, which is quarried in the neighborhood, and sometimes of marble, which is, however, oftener used for doorframes, thresholds, facing of the walls and floors. The rough cast is very carefully made and smoothed. The walls are mostly painted. The roofs are generally beam: arches rarely occur. There are not many specimens of the more elaborate style of architecture; the buildings are generally simple. Excepting the temples the columns are almost all Doric or Tuscan. The only ornaments that occur are parts of the marble pilasters carved with winding plants and insects of remarkable execution.

We return to Rome and to the works of the successor of Titus.

8. Domitian. This unworthy brother of Titus busied himself a great deal with building, and restored almost all the buildings that had suffered by the fire under Titus. Among these was the temple of the Capitoline gods. This temple, which Domitian erected with great magnificence, was based upon a quadrangular substructure of freestone, with truncated corners, upon the Capitoline hill, and this octagonal platform (*pl.* 15, *fig.* 7) is surrounded by a high wall, on the inside of which statues and columns were erected. Towards the south was a Corinthian portico of eight columns in two rows, closed behind by four great pillars, forming three passages, and to which was joined in the interior of the vestibule a back portico of four smooth Corinthian columns. Near the steps of the platform were two smaller temples, the object of which is unknown. Upon the platform itself, arose, upon an elevation of three steps, the temple of the Capitoline divinities, of a peculiar arrangement. It was properly an immense hall of columns with a back wall, and under the roof of this hall lay, towards the rear, the temples of Jupiter, Juno, and Minerva, which had walls in common, and of which the temple of Jupiter Capitolinus was the middle one (*fig.* 6). The hall had six Corinthian columns of Pentelican marble, which were brought, already sculptured, from Athens. They were very beautifully proportioned, but it had been forgotten that, owing to the unusual columnar distances of the Capitoline ($3\frac{1}{2}$, 5, and 7 diameters) the columns should have been larger, so that when they were erected they seemed scant. The hall had in front three rows of columns, one behind the other, which corresponded in columnar

distances with the temples lying behind. Then came a fourth row in the line of the antæ of Jupiter's temple, a fifth in that of the antæ of the temples of Juno and Minerva, and on each side another column, and finally the corner pillars of the rear wall.

The temple of Jupiter had, inside, double tiers of columns, twelve below and six above, or a hypæthral order. Along the side walls were, on the outside, auxiliary altars; and upon the platform, on the outside of the hall, several pedestals with groups of sculptures and two little temples or chapels, the one four-sided, the other round. How great the splendor of this structure must have been may be surmised from the fact that the gilding alone cost more than 12,000 Attic talents (about twenty millions of dollars), as Plutarch, Suetonius, and Martial assure us.

Besides this, Domitian built a Stadium, an Odeon, and a Naumachia, for which a lake was formed from the Tiber and circularly walled. We have treated this building among the Naval Sciences, and have given a representation of it in Plates, Division VI. *pl.* 2, *fig.* 12. Domitian also enlarged the temple of Jupiter, built by Livia, the wife of Augustus, in Forli, or the old Forum Livii on the Æmilian way, of which we have given the ground plan in *pl.* 15, *fig.* 15, and which forms a Corinthian amphiprostylos peripteros, with six columns in front and 11 at the sides, entirely in the old Greek style.

To the great works of Domitian belongs the plan of a great Forum with the temple of Minerva and a little temple of Janus. This forum was finished, however, by his successor, Nerva, and is thence called from him. It is known also, however, as the Forum of Domitian; or, from the temple of Minerva, Forum Palladium; or, because it was a thoroughfare, Forum Transitorium or Pervium. *Pl.* 13, *fig.* 17, gives the ground plan, and *fig.* 16 the lateral section with a view of the temple of Minerva. The Forum was protected upon both sides with a wall crowned with an attic and adorned with Corinthian columns. The front side forms a fivefold passage which, on the inside, has a portico with four columns.

The rear side includes the temple of Minerva, and there were arched gateways upon both sides. There are still remains of the walls and columns, and also of the reliefs of the attic, in which Minerva was represented instructing virgins in female tasks. The temple of Minerva was a beautiful Corinthian prostylos with six white marble columns in front; the cella, behind, was semicircularly closed, and on the long side-walls there were columns with a richly ornamented frieze. The little temple of Janus was a singular building, of which the form may yet be seen in the middle of the Forum. It was completely quadrate, and had on each side four high Corinthian columns whose middle distances were, however, much wider than those on the sides. These twelve columns supported a rich entablature, with an attic which formed a platform upon which stood a bust of Janus with four heads. This entire structure, however, was only a canopy over the temple proper, which was inclosed in walls only half as high as the eight columns between which they stood. These walls supported a cornice and attic, which again formed a platform under the before-mentioned canopy. On each side between the middle columns

was a door opening into a portico of two little Corinthian columns with a gable over them, whose roof rested against the attic.

The triumphal arches and arches of honor were among the architectural works that rose to prominence under the government of Domitian. He erected many of them in all parts of the city, and adorned them very richly. To this time, also, belongs a triumphal arch decreed by the senate and Roman people to Titus on occasion of his taking Jerusalem. The greater part of this work yet remains, and *pl.* 18, *fig.* 17, gives a view of it; *fig.* 18, its ground plan. That this arch was erected after the death of Titus appears from the inscription which calls the emperor "the deified;" and the middle of the spring of the arch is sculptured in half raised work with his apotheosis, where he sits upon an eagle. This bas-relief, and above all the sculptures of this arch, indicate an exquisite style; but the architecture is less praiseworthy, overloaded as it is with ornament. This arch is the most ancient monument in the composite style, on which over the usual Corinthian capital the Ionic volutes appear. Of this time also is the no less simple than beautiful triumphal arch upon the bridge of Santonum, the modern Xaintes on the Charente in France, where there are many other Roman remains: *pl.* 17, *fig.* 16, *a* and *b*, give the general view and ground plan of this arch. Whether also the arch of Gabius in Verona, near Castello Vecchio, which we have represented in elevation and ground plan, *pl.* 17, *fig.* 17 *a* and *b*, belongs to this or a later period, perhaps that of the emperor Gallienus, which its mediocre architecture induces us to suspect, must remain uncertain, as neither the family of Gabius nor the name of the architect L. Vitruvius Cerdo is mentioned elsewhere. We must also mention here a very richly adorned triumphal arch which was erected in honor of Marius in Arausio, the modern Orange in the department of Vaucluse in France, of which *pl.* 18, *fig.* 15, gives the general view, and *fig.* 16, the ground plan. The arrangement of the gables upon the sides, and of the sculptured panels between the four gables, is peculiar. The sculptures are neatly done and in a good style. Arausio is distinguished for its antiquities, particularly for its amphitheatre, the only entire one remaining in Europe. There was formerly a little hamlet in the interior of this building, which the Department of Vaucluse purchased and removed, and left the theatre unincumbered. The arch of Augustus at Pola (*fig.* 20, general view, *fig.* 21, ground plan) is remarkable for a simply beautiful form, and was built either under Domitian or his predecessor.

But Domitian did not lavish the wealth of his kingdom only upon public buildings. He did much for his private edifices, and especially for the Capitoline house and the villa in Albano. The Basilica was adorned with great splendor. The rarest stones were used; the richest ornaments were everywhere lavished so that even the smallest architrave soffits were garnished with costly fillings (*pl.* 19, *fig.* 28). The hall was arched with unusual loftiness and represented the starry heavens. Domitian expended no less upon his estate in Albano, where he gave great plays, and even invited the whole senate thither. The ruins of this villa are yet visible between castle Gondolfo and the lake of Albano, and there are yet very

beautiful remains of the various orders, among others the fine Doric order of which *fig.* 4 shows the capital, and which, to all appearance, served Vignola afterwards as the type of his Roman Doric style. We shall return to this order.

9. Nerva. After the long peaceful reign of Augustus which was so fostering to the development of art, the palmiest art-days of the Roman empire were those which fell in the reigns of Nerva to Commodus, the unworthy son of Marcus Aurelius, that is from the year 96 to 180 of the Christian era; and art took in this time its highest sweep, to fall so much the more quickly. Nerva was too old when he ascended the throne, and reigned too short a time to complete any important edifices, and we have already spoken of the completion and dedication of the Forum begun by Domitian.

10. Trajan. Although no buildings illustrated the first years of Trajan's reign, yet they increased afterwards so rapidly that Constantine the Great was accustomed to call Trajan the wall plant (*Herba parietaria*), because his name was so universally engraved upon the buildings he had erected. Trajan's first great work was the enlargement of the Circus Maximus, which then held 260,000 spectators, but afterwards, according to Publius Victor, could contain 385,000 people. Trajan wished that the Roman people should have place in the circus, and he extended the circus, which was then 4½ stadia (2300 paces) long, that he might increase the number of seats. Other important buildings were the Baths and the Odeon, of which Apollodorus was the architect. New temples and halls were not built in his reign, and his works of this kind were limited to restorations.

Trajan's greatest work in the city was the forum, named from him, a work which has always excited universal wonder. The great triumphal column erected to the emperor by the senate and the people, yet remains, and recently the ground around it has been excavated, and a great number of granite pillars as well as fragments of statuary and architectural details have been brought to light, and again erected upon their old sites. But in this excavation the whole extent of the old forum has not been revealed, and remains still undetermined. In order to obtain the requisite space, Trajan had a part of the Quirinal hill removed and the space levelled as deep as the height of the column in the middle of the forum. The buildings which adorned this forum, were the column in its midst, the Basilica Ulpia, the Libraries, the Triumphal Arches, the Temple of Trajan, and the Colonnades leading directly across the place.

Like all the Roman forums, it was a long quadrangle. The column is a magnificent relic of Roman greatness. *Pl.* 18, *figs.* 24 to 30, are devoted to its representation; *fig.* 24 gives the general view, *fig.* 28 is the bronze statue of the emperor, which stood upon the summit, where now that of the Apostle Peter stands (23 feet in height); *fig.* 25, is the section of the column with the staircase; *fig.* 26, is a horizontal section through the foundation; *fig.* 27, the same through the shaft; *fig.* 29, is a Roman coin, upon which the column is represented; *fig.* 30, a perspective view with Trajan's Temple to the right. Including base and capital the column is 92 feet high, the substructure on which it rests is 17 feet high, and the round

support for the statue is 13 feet high, so that the height of the whole monument with the statue is 145 feet. In the interior there are 185 steps; the staircase is illuminated by holes cut in the circumference, expanding inwards.

The lower diameter of the column is a little over 11, and the upper 10 feet. It is constructed of huge blocks of white marble, which were originally united by brass clamps. Every block fills out the full circle of the column, and the steps are wrought into them, which form the winding staircase. The square foundation is composed of similar masses, with the door on the south side, from which the steps conveniently wind. Upon the flat surface of the capital is a spacious walk around the base that supports the statue.

The sides of the foundation are garnished with a beautiful top cornice and base moulding raised flat, adorned with weapons of war; the torus or bolster of the Doric base forms a laurel wreath. Around the shaft of the column the sculptures ascend to the summit and present the wars of Trajan with the Dacians. In proportion to the height and its distance from the spectator, the upper figures are increased in size according to optical laws. Notwithstanding this, from the good arrangement of its reduction, the effect of the shaft is very pleasing. The unpleasing part is the consideration of details. The execution, although skilful, is studied only with great trouble because the eye is wearied by the increasing distance, and the examiner, in contemplating the column, must constantly move round and round it. The wonder is, that the work is so well preserved, as in the Middle Ages the bronze clamps were torn from it.

Of the other works of this emperor, we must mention the bridge he built over the Danube. It consisted of 20 piles of freestone, each one of which, without the foundation, was 150 feet high and 60 feet broad. The spaces between the piles, or the spring of the bridge arches, was about 170 feet. By the so-called iron gate between Servia and Wallachia, remains of a stone bridge have been discovered, supposed to be this bridge of Trajan, but erroneously, for they do not correspond with the description by Dio Cassius. They probably belonged to the bridge built afterwards by Constantine.

Trajan built also the road through the Pontine marshes, and the fine road from Beneventum to Brundusium. A Triumphal Arch erected to the emperor in Beneventum in the 114th year of our era is yet standing. *Pl.* 18, *fig.* 11, gives a view of this ruin; *fig.* 12, and *pl.* 17, *fig.* 19[b], the ground plan; *fig.* 19[a], gives the elevation of this arch, which is commonly called the Golden Gate. It is of Parian marble, and is completely preserved. Its height is something over 80 feet, its breadth half as much, and its depth 19 feet. The opening of the arch is about 17 feet, and on each side there are two columns of the Composite order directly against the wall. The columns are something over 19 feet high, and rest upon a stylobate running under all of them. Architrave, frieze, and cornice are in the best harmony, and the Attic bases of the columns are remarkably well profiled. The reliefs between the columns represent events from the emperor's life. In the archivolts are Victories with crowns and banners. The frieze is adorned with a triumphal procession in half raised work; and the attic shows on both sides of the inscription remarkably fine bas-reliefs.

Trajan did much also for hydraulic architecture, by enriching the already noble system of aqueducts. He built two harbors upon the Italian shore; the one was at Ancona, upon the Adriatic sea, where the marble arch upon the harbor dam still exists. *Fig.* 18 [a], is the general view of it; *fig.* 18 [b], the ground plan.

This arch, whether viewed as a whole or in detail, is very beautiful, although the shoulder-pieces of the cornice and of the attic are not in the best style. The two keystones of the arch joined by a female head, are very fine.

11. Hadrian. The activity in art of Trajan's successor, Hadrian, surpassed all previous efforts. Building in the provinces was prosecuted with no less zeal than in the capital. Hadrian was not only a friend of art, but he pursued its practice with almost more passion than became a prince. He drew, like King Louis I. of Bavaria, the plans of buildings, which he had executed, and was much displeased if the architects found fault with them. This was the case with the double temple of Venus at Rome, and which the emperor had sketched and laid the drawing before Apollodorus. When this artist saw that the sitting figures were so large in proportion to the little temple that they could not stand up, and ventured to say so, Hadrian caused him to be executed, as Dio Cassius relates. This double temple of Venus and Rome was one of the most important, not only of those which Hadrian undertook, but of all which adorned the city. *Pl.* 16, *fig.* 1, gives the section through the colonnade with the view of the temple; *fig.* 2, the longitudinal section; *fig.* 3, the ground plan of the whole; *fig.* 4, shows a fragment from the left corner of the gable of the portico; and *figs.* 5 and 6 are views of the temple upon Roman coins.

The most recent excavations, under the auspices of the papal government, show that the two temples were surrounded by columns, which were to the number of twenty on the long side, of a fine Corinthian style, and on the short side ten, from which the temple would appear to have been a pseudodipteros decastylos. The temple itself was also surrounded by a court, inclosed with colonnades, and the whole rested upon massive substructures, higher towards the amphitheatre than towards the forum where the ground lay higher. The columns around the temple were of white marble, and the brickwork of the walls was faced with the same. The colonnade of the peribolus was of grey granite, with ceilings of gilded brass, which Pope Honorius I. removed to roof St. Peter's. The arrangement of the double cella of this temple appears so clearly from the ground plan and sections that we shall not here further enlarge upon it.

Hadrian, by the architect Decrianus, removed the Neronian sun-colossus to another spot, and effected it by twenty-four elephants drawing it in an upright posture. The emperor also built an athenæum in which orators and poets might exercise themselves in Latin and Greek, and speak in public.

One of Hadrian's great buildings was his Mausoleum on the right bank of the Tiber, now called the castle of St. Angelo. *Pl.* 18, *fig.* 1, is the general view of this building as it originally appeared, although all its

ornaments and even the marble slabs that faced the foundation have disappeared, since the building was made a fortress. *Fig.* 2 is a horizontal section above the foundation; *fig.* 3, a similar one through the lower part of the circular superstructure; *fig.* 4 through the first columnar superstructure, and *fig.* 5 through the second; *figs.* 6 and 7, are vertical sections of the building itself, which is connected with the bridge of St. Angelo.

The lower part of this Mausoleum formed a square of which the sides were 250 feet long and 57⅔ feet high. Upon this stands a round structure whose diameter is 201⅔ feet. The columns were 32 feet, 5 inches high, the entablature 8⅔ feet, and upon this second part stood a third circular building of less diameter. Under the covered colonnade, in the intercolumniations, bronze and marble statues were placed. History relates that Belisarius, besieged in this place by the Gauls (and it is still the citadel of Rome), threw many of these statues down upon the enemy. A flower crowned the apex of the monument. Others assert that the statue of Hadrian in a chariot with four horses abreast stood there. The flower, or rather the cone of fir, is eleven feet high, and still exists, standing in a niche of the Vatican fronting the garden. Twenty-four fluted Corinthian columns, which belonged to the first perizonium, were, in Constantine's time, when the building began to decay, taken away and built into the church of San Paolo fuori le mure. The places for the sarcophagus and the funeral urns of the deceased of the imperial family, were partly in the vault of the square substructure, partly in the great hall that occupies the middle part of the building. A staircase in the wall of the tower led to the upper platform of the monument, upon which the roof was stretched in the form of a tent. Other authorities remove the roof and set upon the platform a little round temple of Hadrian, and say that the 24 columns in the Church of St. Paul formed the peripteros of the temple. There is one passage in Herodian which favors this idea, speaking of the urn of Septimius Severus which was placed in a temple upon the mausoleum of Hadrian, where reposed the remains of Marcus and other friends of Hadrian.

Hadrian's Villa Tiburtina (Tivoli) was thirty miles in circumference, and contained buildings for which the imperial recollections of travel supplied names, as the Lyceum, the Academy, the Prytaneum, the Pœkile, the Canopus, &c. There was also a vale of Tempe, and a Hades. The ruins are constantly explored, and new antiquities brought to light. In the middle ages two huge limekilns stood here, that did nothing but convert the marble remains into lime. The walls, robbed of their facing, revealed the network (*reticulatum*) and brick-work very neatly executed, and many cast vaults made of little stones and lime.

Hadrian's architectural achievements in the provinces, and especially in Athens, were very great. The arch of honor yet standing shows their character. This had on one side the inscription, "This is Athens, the old city of Theseus," and on the other, "This is the city of Hadrian, and not of Theseus." On this side of the arch lay that part of the city which Hadrian had adorned and almost rebuilt. We have already mentioned

how entirely the emperor achieved his purpose, in our reference to the restoration of the temples of the Olympian Jupiter by Cossutius, of that of Jupiter Panhellenius, and of Juno. Hadrian built also a great deal in Egypt, where he founded the town of Antinoe.

12. Antoninus Pius. The peaceful aspect of affairs which distinguished the government of Hadrian continued through that of Antoninus, which was among the happiest reigns of the Roman empire. The culminating period of art had been passed, but still it was a favorable season, and already when consul the emperor had erected several important buildings. One of his first undertakings after becoming emperor was honoring his predecessor by the erection of a temple against the will of the senate, in the villa of Cicero at Puteoli, where Hadrian died. Then he restored the Grecostasis, where the foreign embassies were received, and the amphitheatre, and completed the building of the mausoleum of Hadrian, and the restoration of the Pantheon, which had suffered by fire. The emperor had a special regard for Æsculapius, whose shrine of pilgrimage at Epidaurus he especially favored, and erected there baths, and a common sanctuary for Hygeia, Æsculapius, and the Egyptian Apollo, and a hospital and lying-in retreat for the inhabitants. He also restored the temple of Æsculapius upon the island of the Tiber (see page 61), and gave to the island itself that ship-form which it still retains in the circumference of its stone walls.

There yet remains in Rome a monument, which according to the inscription was dedicated to the deified Antoninus and his spouse Faustina, but which, we believe, was erected while he yet lived. Faustina died in the third year of her husband's reign, and the senate built a temple to her, an honor which they accorded also to Antoninus upon his death. They erected, however, no separate temple, but they removed the ornaments from the frieze of the temple of Faustina, which bore upon the architrave the name of the empress, and replaced them with the name of Antoninus. *Plate* 11, *fig.* 9, gives the general view of this temple; *fig.* 10 is the ground plan, and *pl.* 11, *figs.* 11 and 12, are two Roman coins, upon which occur representations of the temple. The columns of the portico of this temple, which yet remain, are not fluted, and are built of green and mottled marble. The profiles upon this monument are beautiful, the execution careful, and the reduction of the columns is in a straight line. There were six columns in front and three on the sides. The foundation is 15 feet high, and has 21 steps; the columns are 4 feet, 6 inches in diameter, and 43 feet, $8\frac{1}{4}$ inches high. The monument itself is now mostly built into the church of San Lorenzo in Miranda, and was in the 7th century a Christian basilica. The walls were built of tufa, and were formerly faced with marble.

13. Marcus Aurelius, L. Verus, Commodus. The prolonged reign of Marcus Aurelius, a man remarkable in every respect, who took L. Verus as his colleague, offers little for remark in the history of architecture; either because his government was disturbed by many misfortunes, or because the Stoic philosophy to which the emperor attached himself engrossed his attention to the detriment of art. He was not deficient in knowledge of the subject, for he was himself a painter. Aurelius and Verus

dedicated to their father Antoninus a memorial column of one huge granite block upon a pedestal of white marble. The bronze statue of the deified emperor stood upon the summit. During the middle ages the column which stood upon the Campus Martius fell, and remained buried in rubbish until it was discovered by chance. The attempt was made to erect it again, but by an unhappy chance the cables took fire, the column again fell, and was broken into many pieces. The pedestal is now in the Museum Pio Clementino. Lucius Verus built himself a magnificent villa not far from Rome on the Via Claudia, where many marble remains have been excavated. To this time also belong many fine structures which a private citizen, Herodes Atticus, the teacher of Verus, erected, and which we have already partly enumerated during our glance at Athens (page 41).

But if Marcus Aurelius in his own person achieved little in architecture, there were a multitude of monuments erected in his honor. In the 17th century there yet stood in Rome a triumphal arch of this emperor, which was destroyed because it narrowed the Corso. The sculptures taken from it, representing the victory of Marcus Aurelius over the Marcomanni, are now in the capitol. The second monument is the great triumphal column whereupon, as on the column of Trajan, the campaigns of the emperor against the Marcomanni and Quadi are represented. Upon the summit stood the statue of the emperor, which has been since replaced by that of the apostle Paul. *Pl.* 18, *fig.* 31, gives the general view of this column; *fig.* 32, its section; *fig.* 34, the statue which formerly stood upon it; *fig.* 33, the horizontal section through the column; *fig.* 35 [a] and [b] are coins upon which the column occurs; and *fig.* 36, is the perspective view of the place upon which it stands, with the adjacent temple of Marcus Aurelius, which had 8 Corinthian columns in front and 11 on the sides, and of which 11 columns and a part of the cella remain. The frieze is smooth and convex, and the whole indicates an already declining art. So also the column which is 15 feet thick below, and with the statue is 176 feet high, although of great importance to history, is yet not to be compared with its type, the column of Trajan; for it is not nearly so well cut, and its sculptures are of a much inferior style.

The last mentioned monuments belong to the reign of Commodus, the unworthy son of Marcus Aurelius, and are almost the only ones of that time. Even these were not wholly finished during his reign.

Let us revert now, upon the threshold of declining art, to the architectural achievements from Augustus to Antoninus. They are certainly greater than those of any other age, nor could any other government than imperial Rome have performed them. The colossal was the order of the day. The most costly material was collected from every quarter, and no limits were prescribed to the architect, except such as his own genius and will imposed. Temples of great size and magnificence, and of new forms, were erected; and the fora were adorned with basilicas, temples, memorial columns, and libraries. To the Julian period the Augustan soon associated itself, then that of Domitian, and at last the splendid era of Trajan. Rome had its coliseum, and the ruins of similar buildings meet the eye frequently in other

regions, as in Capua, Pozzuoli, Pola, Verona, Nismes. The baths were a species of building not seen before. Marcus Agrippa gave the example; then followed the splendid works of Nero, Titus, the Suranian of Trajan, and the Cleandrian under Commodus. Rome had public colonnades earlier, but they did not approach in beauty to those of Agrippa, Augustus, or Nero. In respect of palaces we can hardly mention the Palatine of Domitian with the golden house of Nero; and the villas of Tiberius at Capri, Domitian's Albanum, Trajan's villa, the Lorium of Antonine, appear insignificant in comparison with Hadrian's sumptuous villa at Tivoli.

We must add to these, the sepulchral monuments and memorial arches. Triumphal and memorial arches, even temples, are now more common in Rome and in the provinces, and are adorned upon all sides with the most costly bas-reliefs. Memorial columns rise on every hand, and surpass even the obelisks in height. Augustus and Caligula imported the last from Egypt, and even Constantine had one brought to Rome. Yet, near the columns of Trajan and of Marcus Aurelius, they lose all importance. If we now include the roads and bridges in and about Rome and the provinces, we shall have an idea of the grandeur of art during this period.

There was abundance of the best material, and a great number of buildings, the style in most of which was masterly, yet less in the Doric and Ionic than in the splendid Corinthian capitals. There was, however, no lack of empirics who obtruded everywhere, and treated art arbitrarily. The rage for novelty was also dangerous to architecture, and names like Severus, Celer, and Apollodorus are of rare occurrence at any period. Among the emperors who fostered art, Hadrian deserves the first place; and his reign, in the history of art, marks the era of the last efforts towards the sublime.

14. Septimius Severus. The disturbances consequent upon the assassination of Commodus interrupted every architectural enterprise. Pertinax and his three successors were only apparitions upon the theatre of universal empire, until Septimius Severus at length assumed the government, and as a warrior and educated man, undertook many works of importance for the improvement of the city. He was also engaged in restorations. To his larger works belongs a very large temple of Bacchus and Hercules, of whose site, however, no trace remains. But there are two monuments in honor of this emperor and of his fortunate Oriental campaigns. The largest is a triumphal arch which the people and the senate dedicated to the emperor and to his sons, 203 A. D. *Pl.* 17, *fig.* 20, shows the section of this work. It lies opposite the Capitoline hill, and was built of blocks of Pentelican marble without cement. It is entirely preserved, although it has often suffered from fire. The whole height is about 56 feet, the breadth 72 feet, and the depth about 22 feet. It has three openings, of which the middle is the largest, and on each side stand four fluted columns of the Composite order, disengaged, and with pilasters behind them. These columns are 2 feet, 10 inches in diameter, and rest upon pedestals which on three sides have bas-reliefs representing captive enemies. The entablature, which is supported by the columns, formerly bore statues in the same manner as the arch of Constantine (*pl.* 17, *fig.* 21). The

archivolts are in a pure and handsome style. The middle arch is 38 feet high by 22 feet span. The little arches are 23 feet high and about 10½ wide. The arches have beautiful deep panels with rosettes. The three arches communicate with each other through little doors which are also arched. The keystones of the great arch are adorned with armed warriors, and the archivolts with Genii of Glory with trophies; those of the smaller ones with Victories with palm branches. Over the little arches there is between the columns, first a frieze with a triumphal procession, and over that bas-reliefs with many figures representing battle scenes, indifferently executed. Here the decline of art that distinguished this period is very evident. There are no bas-reliefs upon the great frieze or the attic. In the interior of the arch is a staircase leading to a platform, upon which, formerly, was a triumphal chariot with six horses abreast, upon which stood statues of Septimius Severus, Caracalla, and Geta. The money changers and traders erected a little triumphal arch in honor of the emperor serving as an entrance to the Forum Boarium. Here Severus was represented with his wife Julia, and his sons Caracalla and Geta sacrificing. But later, after Caracalla had murdered his brother Geta, he carried his hatred to the degree of removing his figure from this bas-relief.

An important building of the emperor Septimius Severus was the Septizonium, of which *pl.* 18, *fig.* 10, gives the general view. The emperor erected it as a family sepulchre on the Appian Way. His funeral urn was not, however, placed here, but in the tomb of the Antonines, *i. e.* of Hadrian, but the body of Geta was buried here. Nothing remains of this building, but Martianus has left a description of it, from the extensive ruins existing in his time. There were seven tiers of columns one over the other, but according to others there were only three stories with seven rows of columns.

Sixtus V. took a great many yellow marble columns from this monument for St. Peter's. It seems as if the vision of the Tower of Baal at Babylon had floated before the minds of the builders of this monument, and of Hadrian's mausoleum.

Septimius Severus built also a great number of splendid dwelling-houses, which he presented to his friends. One of these houses was called the Palace of the Parthians, and another the Lateran. The Pantheon, the Porch of Octavia, and the temple of Jupiter Tonans, were repaired by him.

15. Caracalla. Upon the buildings which bear the name of Septimius Severus appears also that of his son Marcus Aurelius Antoninus Pius, for he received the name Caracalla from the tabard which he wore, and which he enjoined his soldiers to wear. To the buildings which he independently erected belong preëminently the baths, whose walls yet remain, and which bear witness to the extent of the undertaking, which seems to have surpassed all similar ones. The masonry is of brick, and looks as in its best days. The vaults are all cast work, made, however, not of tufa but of pumice; and are firm and light, for which reason they do not weigh heavily upon their supports. Some of them were so flat that it was supposed they had a metal support within. They now lie in rubbish, and it is evident that there was no metal, but that they held by their own lightness. The excavated

remains indicate the magnificence of these baths. Eight huge granite columns have been discovered, which supported the great hall, and of which one now stands in Florence, upon the Piazza Trinita. Here also were found the two marble reservoirs that now adorn the fountains upon the Piazza Farnèse in Rome. From here too came the Farnese Hercules, the Flora, and the well known group of the Farnese Bull.

Caracalla was much devoted to the Egyptian worship, for which reason Isis and Serapis, which had formerly only a shrine, were now elevated to the dignity of several temples; and to this time also belongs the restoration of the temple of Serapis in Pozzuoli, of which we have already spoken (page 74), and of which *pl.* 13, *fig.* 9, gives the ground plan.

16. Heliogabalus. We should no more have mentioned this emperor than we did Macrinus and his son, if he had not committed the folly of making the Syrian god Helagabal the Roman national god, and of erecting to him a temple and a chapel, and if he had not built a hall of council for women, in which they were to deliberate on matters of female dress and other frivolities. The hall was situated upon the Quirinal, and the remains of the walls are yet visible in the garden of the Palace Colonna. The emperor also restored the amphitheatre that had suffered from fire.

17. Alexander Severus. This emperor loved the arts and sciences, and was himself versed in mathematics and painting. He erected rooms for scientific lectures, and paid teachers especially for them. The forum of Nerva (*pl.* 13, *figs.* 16 and 17) he adorned with the statue of the deified emperor, and in his private chapel (Lararium) he had a separate room for the portraits of such men as were famous for their writings or life. Here were Virgil, Cicero, Apollonius of Tyana, Abraham, and Christ. The latter he reckoned among the gods, and intended to build him a temple. He restored the theatre of Marcellus, the great circus, and the amphitheatre; and he completed the stoa in the baths of Caracalla. An important building of this emperor was the Basilica Alexandrina, in the neighborhood of the Campus Martius. It was 100 feet broad and 1000 feet long, and rested entirely upon columns, and seems, therefore, to have been a stoa. This emperor erected at Ostia a round temple (*pl.* 12, *fig.* 15, general view; *fig.* 16, section) to Portumnus, the tutelar god of harbors. This temple was a beautiful peripteros, surrounded by 24 Corinthian columns, and is the first in which the architrave and entablature are superseded by arches, and vaults and where, consequently, the colonnade has no straight ceiling. The masonry is brick, and has been faced with marble; the dome finely vaulted and garnished with very beautiful ornaments, but not cassetted.

18. The Emperors from Maximus to Gallienus. The emperors that follow had, by the general short duration of their reigns, little inclination to busy themselves with the arts, which consequently fell more and more into decay. For this reason we shall include in one period the interval between the years 235 and 261 of our era, as the buildings then erected are neither important nor of great architectural value. Properly, Gordianus was the only one who built at all. He erected his family palace and then his villa on the Prænestine Way, in which was a colonnade which had 200 columns, of which

50 were of Carian, 50 of Claudian, 50 of Synnadian, and 50 of Numidian marble, and every one of these consisted of a single block. Also three basilicas, each with 100 columns, were in this villa, and the baths yielded in magnificence only to those of Rome.

19. Gallienus. Under the feeble Gallienus full confusion broke over the Roman empire. The border inhabitants rose, whilst in the interior strife of long duration commenced between the commanders of the legions. At this time also the temple of Diana at Ephesus fell into decay, which, since its restoration in the time of Alexander the Great, had for 600 years excited the wonder of the world. It was plundered and burned by the Goths. In Rome there were very few and unimportant buildings completed under this emperor, whose chief ambition was to be a great poet. In Verona, however, there are some monuments which we must refer to this time. The first is a city gate, with two arches surmounted by two stories, each consisting of six arched windows. The second story is adorned with columns which are fluted in a spiral form, of which style this is the first example. The third story has pilasters which stand upon projecting consoles, also a new style. According to the inscription upon the gate, it was erected at the same time with the city walls, 265 A. D., of which, however, there are few remains (*pl.* 18, *figs.* 1[a], elevation; *fig.* 19[b], plan.) The other monuments are also gates, somewhat similar to that described, but adorned with columns, and in an inferior style. To this time also belongs the arch of Gabius in Verona, of which we have already spoken (page 81), and of which *pl.* 17, *fig.* 17[a], and[b], give the elevation and ground plan.

20. Claudius Gothicus. This emperor reigned too short a time to build anything, but he reigned so well that almost all the cities aimed at perpetuating his memory by gates of honor. The senate of Rome placed his golden statue, ten feet high, before the temple of the Capitoline divinities, and a silver statue of the emperor weighing 1500 pounds upon the tribune of the Forum.

21. Aurelian. This emperor acted energetically and reduced the border population to tranquillity; yet the feeling of the weakness of the metropolis was so great that it was the first care of the emperor to surround it with strong walls. We have treated of these walls among Military Sciences (Vol. II. p. 618). See Plates Division V., *pl.* 43, *figs.* 6—9, and *pl.* 42, *figs.* 19, 20.

The chief building which this emperor erected in Rome was the temple of the deity of the Sun, whose temple in Palmyra he had restored, when his soldiers had injured and plundered the building, proving also in Rome the honor in which he held this god. He placed in this temple besides the statue of the Sun, that of Belus also, and probably the temple was arranged in the interior like that of Palmyra. *Pl.* 15, *fig.* 8, shows the outer view, and *pl.* 16, *fig.* 15, the ground plan of the Temple of the Sun in Rome. According to P. Victor, this temple lay in the 7th district, which included a part of the Quirinal hill. The modern topographers of Rome may therefore be right in asserting that the remains of the rich marble entablature found in the gardens of the Colonna in Rome belong to this temple.

The temple was not accessible upon all sides, being built with its back against another building, as the remains of walls and substructures show, which Serlio and Palladio saw, but of which nothing more now remains. The plan of the temple cannot be given with certainty. Our drawings are made according to Palladio's report, who saw the most of it and drew a restoration of it, and according to the idea of Canina. The temple itself stood in a great court, whose rear side was formed by the above mentioned walls of other buildings. On both sides were walls with semicircular niches with statues, and a similar wall inclosed the front side until the Baths of Constantine were erected there. The temple is a pseudodipteros with three rows of columns in front of the cella, of which the foremost had 12, the two others only 6 columns standing behind the first, third, and fifth columns of the front on both sides of the door. This arrangement is unusual, and indicates a considerable decline of art. In the interior the temple was a hypæthros, for Vitruvius states that all temples which are dedicated to the Sun must admit the sunlight from above. As the great height of the temple necessitated two tiers of columns one over the other, galleries were built on both sides which extended round upon the fore and rear walls. These galleries were ascended by means of staircases in the vestibule of the temple. It is probable that the acroteria at the top of the gable was adorned with the statue of Helios in his chariot drawn by the horses of the sun.

22. Tacitus, Probus to Diocletian. Tacitus was too old and reigned too short a time to undertake any great works, but he prosecuted the work of the Forum of Ostia, commenced by Aurelian, and sent thither, at his own expense, one hundred columns of Numidian marble, 23 feet long. Upon the site of his own house in Rome he erected baths, and sold his property in Mauritania in order to improve, with the proceeds, the Capitoline temple. Probus undertook the construction of several highways and hydraulic works, upon which he employed the legions that they might not be idle in time of peace. This, however, was the occasion of his death; for the soldiers who did not wish to work, slew the emperor, and afterwards erected a monument in his honor.

Of the emperors who succeeded Probus we have nothing to remark until the reign of Diocletian, who was a prince no less valiant than active, and completed important buildings in Rome, Milan, Carthage, and Nicomedia. Of Diocletian's architectural activity the most striking proofs are the Baths in Rome, the Villa of Salona, and the column in Alexandria. The Baths of Diocletian were only commenced by that emperor and were completed under Constantine and Galerius, but were nevertheless named from their founder. The ruins of this structure are very extensive, and give a better idea of the style of these magnificent buildings than the ruins of the Baths of Caracalla. The great circular hall, *xystus*, as the middle point of the edifice, has yet the eight great granite columns which supported the cross-vault, and of which we have shown the beautiful Composite capitals in *pl.* 19, *fig.* 15. This hall now forms one of the most beautiful of the Roman churches, viz. Madonna degli Angeli alle Certosa (*pl.* 46, *fig.* 19,

ground plan, and *fig.* 24 section). There are yet visible the main entrance with the rooms where bathers undressed, the various bath halls, and the site of the swimming pond. In the outer circumference, the site of the theatre, two libraries and two round temples, one of which was dedicated to Mercury and the other to Hercules, are still discernible. Here, too, belongs the Doric capital which we have represented in *pl.* 19, *fig.* 4. One of the temples with its dome remains, and serves for a church. Diocletian erected a hall, which he called Iovia, in the neighborhood of the theatre of Pompey.

Quite as considerable as the ruins of the baths are those of the villa of the emperor at Spalatro, the old Salona, whither the emperor withdrew on his abdication, to repose after his reign of twenty-five years. It is evident from the extent and arrangement of these ruins that not a body-guard merely surrounded the emperor in his philosophical retreat, but a large retinue, for a great part of the building seems to have been adapted for dependants. There are also the remains of a Pantheon and of a temple of Jupiter as well as a chapel of Æsculapius. The halls and large and small rooms, the arcades, basilicas, baths, and all the arrangements which the conveniences of an imperial palace demand, are very multifarious.

But size and splendor could not supply the want of a high art, whose decline the buildings of Diocletian all evince. Not only were the columns set upon pedestals, but even upon projecting consoles; and instead of straight architraves there are everywhere arches. The order is almost entirely the Corinthian or the Composite, overloaded with ornaments, while the capitals are thin, stiff, and graceless. The proportions are defective everywhere, the cornices being too high, the friezes convex, and the architraves having only two fillets and a clumsy cyma. The doors are broad and low, and are almost crushed by heavy pediments upon great consoles. Everything is arbitrary, and every law of art seems forgotten. As in Palmyra and Baalbec exuberance and extravagance prevail, so the buildings of Gallienus and of Diocletian indicate the weakness and poverty of age. In place of a beautiful architectural art, there is a miserable empiricism.

23. Constantine and his Family. We now approach the point which we regard as the limit of the architecture of genuine antiquity. Constantine is still a conspicuous figure in the history of the world. In battle he was no less fortunate than brave; and when after a protracted contest with his rivals he found himself at the head of his kingdom, he consecrated the last ten years of his life exclusively to internal affairs. Yet we can here consider his activity only in so far as it is necessary to the knowledge of the state of art of his time, and briefly mention what was accomplished with regard to it under him and his immediate successors.

When Constantine, after the death of Constantius in the year 306 A. D., assumed the command in Gaul, and had secured the borders against invasion from that direction, he marched against the internal foes, and the decisive battle near Rome made him master of the metropolis. The fine arch in Rome is still the witness of this triumph. It was decreed to him by

the Senate and the people, and is the only monument among the buildings of Rome attributable with certainty to the time of Constantine. But in fact no monument is so well adapted as this to show the melancholy state into which architecture and the plastic arts had then fallen. *Pl.* 18, *fig.* 13, gives the elevation; *fig.* 14, the ground plan, and *pl.* 17, *fig.* 21, the section of this arch. The monuments of earlier emperors, with their ornaments, furnished the material. The main proportions of the structure, which on the whole are yet very beautiful, were apparently taken from another triumphal arch, as well as most of the bas-reliefs, and the statues placed over the columns. The great bulk of the work is of marble. The work of the columns indicates the time of Hadrian, the statues and bas-reliefs are of the time of Trajan, Hadrian, and Antonine; only the strips under the round bas-reliefs bear sculptures which have reference to Constantine and the conquest of Rome. Besides these, the Victories in the archivolts and on the pedestals of the columns belong to that time.

All these sculptures, however, at once impress the spectator with the decline of art; and the incorrect proportions and clumsy execution of the cornices have the same effect. At the same time, Constantine dedicated the basilica named after him, which his predecessor Maxentius had begun to build; and he likewise adorned the circus and built the baths which bear his name.

To this time also belongs, to judge from the architecture, the monument existing in Treves called the Porta Nigra, which probably belonged to the fortifications, and was perhaps the residence of the commander of the fortress. The monument of the Secundians near Igel, not far from Treves and the Rhine Bridge of Cologne, of which the remains are visible at low tide between Cologne and Deutz, as well as the bridge over the Danube (probably its remains are near the Iron Gate, see page 84), were all buildings by Constantine. His great undertaking, however, was the foundation of a new residential city, whose progress he fostered so cordially, that the new Rome (which name it long bore in common with the name Constantinopolis) was ready for dedication in the 25th year of his reign, 330 A. D.

Constantine comprehended the tendencies of his age, and the dangers that had long threatened the kingdom were not concealed from him. Only some great reform could avail against them, and the emperor was obliged to oppose a new city to the overgrown metropolis, and thus as it were reduce the queen of cities to the rank of other cities. A new form of government was connected with this change, and Constantine introduced it by separating the municipal power which the general had hitherto exercised in the provinces from the military, appointing special officials for every part of the civil administration, and confining the generals to the army. In the same way the emperor struck at the power of the Roman senate, taking with him into the new residence many of the most distinguished families, and giving them positions there, forming a court, offices, and titles, and so creating an aristocracy dependent upon himself alone. Finally, the emperor, induced by the great number of converts to the Christian religion, in order to obtain a new support, put himself at the head of the movement, and by his countenance controlled the councils of the church.

Architectonically the new Rome was only a phantom of the old. The magnificence of the latter was the fruit of many years of the prime of the empire and of art. In Constantine's time the latter had declined. The colossus of the empire yet stood, but the springs of vitality were dried up. The emperor consequently, to build anew, was obliged to destroy the old. The tolerance of the Christian religion was proclaimed, and the old system fell, and with it fell all of artistic greatness and glory which the people had hitherto achieved, to serve as material for the new order. Only the technicality remained, and this was poor and awkward. Originally, the new city was to have been placed between Troas and Ilium, and the ground was even surveyed, and the marking out of the walls commenced, when the emperor altered his plan and chose the much more eligible site of Byzantium, where he had the further advantage that Byzantium was already a city, needing only improvements. Thus it could after a few years compete with Rome.

Although the building of many Christian churches is ascribed to Constantine, yet the real number must be very small; for on the one hand, Constantine did not adopt the Christian religion until he was quite old, and on the other hand, all the churches contained columns from the heathen temples, and the yet vigorous power of the priests would not then have allowed free play to such vandalism, and the destruction of the buildings. But that Constantine's immediate successors, and even members of his own family, executed such works, appears from the church of St. Agnes, which Constantine's daughter, Constantia, built. It is a three-aisled basilica (*pl.* 27, *fig.* 14, view; *pl.* 46, *fig.* 16, ground plan) of beautiful proportions but built of fragments, having columns of the Composite and Corinthian orders, and of various kinds of marble. Instead of straight architraves, arches are everywhere employed. At this time also was built the mausoleum of Helena, the sister of Constantine, on the Nomentanian Way. It was a circular edifice in the form of the Pantheon, with seven niches in the interior, and a vestibule of four columns. In this mausoleum was the beautiful porphyry sarcophagus, with bas-reliefs representing fighting horsemen and captive barbarians, which now stands in the museum Pio Clementino. Some authorities ascribe this sarcophagus not to Helena the sister, but to Helena the mother of Constantine. Ammianus Marcellinus, however, tells us that a sarcophagus adorned with wreaths of plants, figures of children representing genii, a peacock, and a lamb, was found in a circular edifice like the former, which contained the grave of Constantine's mother. Pius VI. had the sarcophagus brought to the Museum of the Vatican.

7. The Orders.

Before we proceed to the architectural history of the middle ages, it will be necessary to say a few words upon the five orders of columns. As we remarked in our sketch of the architecture under the Roman emperors, all rules had fallen into oblivion with the decline of art towards the close of that period. The buildings of the period betray an uncertainty

in the choice of columns, cornices, and ornaments, and too often the most unfitting details are united to a whole which seems then only a patchwork, in which all harmonious arrangement is wanting. The artists felt this when art gradually awoke from its long sleep, and they perceived the need of again investigating the old rules of art. They had no other material upon which to base their researches than the remains of those ancient buildings that were then in tolerable preservation, and we hence find such artists as Raphael and Michel Angelo zealously busying themselves to form their taste upon the antique monuments, and to measure and draw their details. They were afterwards imitated by such architects as Palladio, Serlio, Alberti, Scamozzi, and Vignola, and so gradually arose from the study of the old monuments the five orders, the Tuscan, Doric, Ionic, Corinthian, and Roman or Composite. But as those artists did not extend their researches beyond Italy, we might even say beyond the immediate precincts of Rome, we find in them references only to the Roman style of building, and the Doric, Ionic, and Corinthian orders of the Greeks are altogether disregarded.

Although the organization of the orders as such is truly the work of the age of the *Renaissance*, and although the results of the investigations of Vignola, as well as of his co-laborers Palladio, Serlio, and Scamozzi, who lived in the 16th century, ought to be mentioned in their chronological order, yet it seems proper to consider the various orders in this place, as they appear to have been the result of the profound study of the architectural remains of Roman antiquity.

Although the various orders as they were classified by these four architects often differ materially, according to the artistic knowledge and taste of the designer, or according to his predilection for a special monument, yet in the following remarks we shall confine ourselves to the orders of Vignola. They have for centuries, by universal consent, taken precedence of those of the other authorities, and were even the only ones considered classic by architects, until a better acquaintance with the architecture of ancient Greece proved the existence of something higher in art than Roman architecture.

To an order belongs, 1, the column, with its base and capital; 2, the entablature, consisting of architrave, frieze, and cornice; 3, the pedestal; 4, the parts necessary to the arches between the columns, that is, the impost with its cornice, the arch with its mouldings, and the intercolumniation. We shall describe these various parts in each of the orders. The measure of which we avail ourselves in the account of the single parts of the orders is the *modulus*, that is, half the diameter of the lower part of the column, an absolute measure, inasmuch as it may be employed upon every column, whether large or small, provided its lower diameter be known. The module of the order may be found when the whole height has been determined. Thus, for example, the Tuscan column has in height 14 modules, and with pedestal and entablature 21 modules, 9 parts (*pl.* 20, *fig.* 1). We remark here that the module is divided, according to Vignola, into 12 parts, and each part into

4 minutes. Other architects divide the module into 24, even into 30 parts; Wiebeking, for instance, into 50 minutes. We, however, follow the division of Vignola. If then we know that a Tuscan order to be employed is 21 feet, 9 inches, in height, the module will be = 1 foot, and the lower diameter of the column be = 2 feet. If the order is 43 feet, 6 inches high, then the module will be = 2 feet, and the lower diameter = 4 feet, from which the module measure may be derived for all details. The Doric column is 16 modules, and the whole order (*pl.* 20, *fig.* 2) 25 modules, 4 parts in height. The Ionic order (*fig.* 3) is 28 modules, 6 parts, the column alone 18 modules. The Corinthian order (*fig.* 4) as well as the Roman or Composite (*fig.* 5) is 32 modules, the columns alone 20 modules in height.

1. The Tuscan Order. The Tuscan order is that which the Etruscans employed in their buildings, and although, as we have already remarked, there were many buildings of this style in Rome, yet no traces of them have come down to us. Vignola was thus obliged to create his Tuscan order, although he cleaves to the slightest trace of it in the works of Vitruvius. *Pl.* 21, *fig.* 1, represents the Tuscan column arrangement, and we see from the accompanying numbers that the shaft of the column has 12 modules, base and capital 1 module, and the entablature one fourth of the whole height, consequently 4½ modules. This relative height of the entablature Vignola adopts in all his orders. *Pl.* 20, *fig.* 6, shows the column arrangement with arches, according to which the breadth of the arches between the imposts is 5½ modules, and the height of the keystone of the arch is 1 module, whereby the point of commencement of the impost cornice, *a* (*fig.* 7), and the archivolt *b*, are readily determined. *Pl.* 23, *fig.* 1, gives the Tuscan arrangement of arches with pedestals to the columns, where the distance from centre to centre of the columns is 12¾ modules, but the span of the arch 8¾ modules. Thereby, the breadth of the imposts is given; so is their height, since the archivolt of the arch = 1 module. *Pl.* 22, *fig.* 1, shows the detailed construction of the Tuscan capital and entablature, where the architrave, *a*, is = 1 module; the frieze, *b*, = 1 module, 2 parts; and the cornice, *c*, = 1 module, 2 parts high. D, is the under view of the cornice; B, the capital of the column C, 1 module high, of which E is the under view. These details determine the reduction of the column as being from 2 modules to 1 module, 7 parts. The numbers in the figure show the various heights and projections. *Pl.* 20, *fig.* 7, shows, in A, the upper view of the half column, and of the pedestal; in B, the impost with its cornice, *a*, and the archivolt, *b*. At A is the view of the pedestal and of the base, with their heights and projections accurately represented. The Tuscan order has the character of simplicity. It has been employed, among other architects, by Le Brosse, in the Palais Luxemburg, by Le Mercier upon the Palais Royal in Paris, and by Mansard in the Orangery at Versailles.

2. The Doric Order. Vignola composed two Doric orders, one with dentals, the other with modillions, which harmonize with each other in the important points, and differ much in detail. For the first style Vignola seems to have taken the Doric order of the theatre of Marcellus in Rome as his type; whilst the other was founded upon the remains discovered at

Albano. The Doric order has its difficulties, on account of the placing of the triglyphs in the frieze, for which reason it is not adapted to all columnar distances, as in many the relation of the metopes to the triglyphs would be untrue. The placing of the columns and the entablature respectively, are shown in *pl.* 21, *fig.* 3, where it appears that in this case, the columns from centre to centre must have distances of 7½ modules if the metopes and triglyphs are to be true. In the arrangement of columns with arches (*pl.* 23, *fig.* 2), the distance must be 10 modules, so that, as 1 triglyph and 1 metope require a space of 2½ modules, 2 triglyphs and 2 metopes may find place; and in the same way in the arrangement of columns upon pedestals, and with arches, the distance must be 15 modules to accommodate 2 more triglyphs, and 2 more metopes. *Pl.* 21, *fig.* 2, gives the details of the entablature, capital, and of the upper part of the shaft of the column of the dental style, in which the reduction of the column to 1 module, 8 parts, may be seen; and the remaining measures to the complete drawing of this order may be partly read, and partly calculated from the adjoining scale. A is the under view of the half column and of the half capital, whence it may be seen that the abacus is square and the echinus round. In B is presented the under view of the entablature, with the ornament of the under view of the corona. *Pl.* 22, *fig.* 3, on the other hand, represents the entablature, and the upper part of the column of the Doric order of the modillion style. Here, instead of the dental, the arrangement of the modillion style is evident, and more plainly in the under view A. The measurements are here also sufficiently indicated, so that we need not enlarge upon them. *Fig.* 2 represents the Doric basis and the Doric pedestal in the front view, and below, the half upper view of the same. In A, there is a part of the impost, with its cornice, and the archivolt, one module broad, which, reckoning from without inwards, consists of a supercilium, a torus, a socle, and two stripes. The Doric order of the dental style is especially adapted for external decoration, on account of the strength of the profile, and of the broad projection of the corona, through which the rain water is carried clear of the building; and on the other hand the modillion style is peculiarly adapted to vestibules, galleries, halls, &c. *Pl.* 19, *fig.* 4, shows the capital of the order of Albano, and *fig.* 5, that of the Baths of Diocletian at Rome, which Scamozzi has taken as the model of his Doric order. Many builders have employed the Doric order without the triglyphs, because in many cases it is almost impossible to obtain a proper distribution of them. So, for example, Bramante in the palace of the Cancelleria in Rome, Raphael in the Chigi Palace, and Bernini in the great colonnade before St. Peter's in Rome, have omitted the triglyphs; and, it would indeed have been very difficult for Bernini to have made a correct disposition of them, since the columns on the exterior have wider distances than those of the interior, on account of the circular form of the colonnade. The arrangement of Michael Angelo on the Farnesian Palace, that of Scamozzi on the new Procurate in Venice, and that of Palladio on the basilica in Vicenza, are very regular.

In *pl.* 20, *fig.* 8, we have given an example of the Greek Doric order,

with the entablature and the upper part of the shaft of the column, its under part with the steps upon which the columns stand, which have no base; next a section through the entablature, and in A the under view of the corona, showing that there are modillions over the metopes, which the Roman Doric order did not have. *Fig.* 9 shows in B the foot and in A the capital of the pilaster, in C the construction of the neck of the column, in D that of the flutings, in E the columnar distance, and on the lower left the construction of the astragal on the under part of the echinus.

3. THE IONIC ORDER. Upon the whole this is one of the most graceful of the orders notwithstanding many irregularities in the capitals, owing to its two different aspects, and which often make it a very difficult order to employ. The two different aspects of the capital arise from the peculiar position of the volutes, which are only seen in front and rear, whilst the sides exhibit the cushions connecting them. It was particularly disagreeable in the corner columns, the sides being freely exposed to view. The Greeks tried to obviate the difficulty by placing the volutes diagonally, thus making them appear in the front views of two different sides. This, however, is only a poor expedient, as it causes an irregularity, and it is therefore preferable to substitute corner pillars for columns, and to give them caps of four equal sides. *Pl.* 21, *fig.* 5, shows the simple Ionic style, exhibiting the rule that the whole order with the entablature should have $22\frac{1}{2}$ modules, of which the column with its base and the capital have 18. *Fig.* 4 shows the complete construction for the capital, and below on the left the arrangement of the eye, in order to construct the spiral of the volute of regular arcs only. To accomplish this, the position and size of the eye of the volute must first be ascertained in accordance with the measures given in *fig.* 3. Next draw the perpendicular A, B, and the horizontal line C, D, through the centre of the eye, construct the square A, C, B, D, and bisect its sides by the perpendiculars 1, 3, and 2, 4. Divide each of these lines into six equal parts, 1, 2, 3, ... 12. Prolong the line 4, 1, to the little disk in *fig.* 4, and make this the centre of the volute. Then place one leg of the compasses in 1 and construct a quadrant from the centre of the volute to the prolongation of the line 1, 2; then construct from 2 with the new radius a quadrant to the prolongation of the line 2, 3; next the quadrants from 3 to 4, and from 4 to 5, always changing the radius according to the distance from the centre of the volute. To obtain the second spiral, proceed in the same manner, constructing the quadrants 5, 6; 6, 7; 7, 8; 8, 9, always changing the radius as before. The third spiral is finally determined by the quadrants 9, 10; 10, 11; 11, 12, and 12 to the top of the capital, constructed with their appropriate radii. The greatest accuracy is required to avoid corners, and to end the volute with the proper curve. The second or parallel spiral is determined in the same manner from the points lying one third of the distance 1–5, towards the interior from the former centres of construction.

The Ionic capital contains the following mouldings (*fig.* 4), a supercilium, *k*, a foliated cyma, *i*, the socle of the volute, *h*, a scotia, *g*, an ovolo with the decorative serpents' eggs, serpents' tongues and arrow heads *f*, a bead,

c, and a socle, *d*. The flutes, *a*, are separated by the ridges, *b*. *Pl.* 22, *fig.* 5, shows the entablature and the capital of the Ionic order, the latter from the front and side, and in half under view. *Fig.* 4, gives the Ionic pedestal and base of the column. Under A is the impost with its cornice and the archivolt, which is $9\frac{1}{4}$ parts broad, and consists of a slab, cornice, and two stripes. *Pl.* 23, *fig.* 4, shows the Ionic arch-arrangement, being $8\frac{1}{2}$ modules span, to $10\frac{1}{2}$ modules of clear columnar distance. *Fig.* 5, shows the same order with pedestals, where the span is eleven modules, by an intercolumniation of thirteen modules. All the measures are given in the drawing. The Ionic capital allows various ornaments; *pl.* 19, *fig.* 7, shows the simple capital of the Temple of Fortuna Virilis in Rome; *fig.* 8, represents an Ionic capital from the villa Borghese, in which sphinxes are arranged as ornaments in a very peculiar manner.

4. The Corinthian Order. We have already aimed to show in the course of this treatise that the Corinthian order was no especial order among the Greeks, but that the Ionic entablature was placed upon capitals adorned in the Egyptian style; that the order was not invented in Rome, and that it is most probably of Phœnician origin. In *pl.* 21, *fig.* 7, we have the simple Corinthian arrangement of columns, whence it appears that the intercolumniation is $4\frac{2}{3}$ modules in the clear, while the column with base and capital has 20 modules, the shaft alone $16\frac{2}{3}$, and the base one. The entire order is 25 modules high, as here, too, Vignola has followed his principle of giving one fourth of the height of the column to the entablature. In the Corinthian arches (*pl.* 23, *fig.* 6), the span is nine modules, and the columnar distance between the centres of the columns is twelve modules. The height of the impost is found by deducting from the height of the column half the span and 1 module from the archivolt. When the columns are placed on pedestals, the span is 12 modules, by a distance of 16 modules, the breadth of the imposts being self-evident and their height as before. The entablature and capital with the upper part of the shafts of this order are given in *pl.* 22, *fig.* 7, with the requisite facilities for calculating the proportions. A is the under view of the corona with the modillions. *Fig.* 6 gives the Corinthian pedestal and base, with the upper view of half these parts; at A is the impost cornice with the archivolt, showing its mouldings, which in this order are usually decorated very richly.

The construction of the Corinthian capital we have endeavored to illustrate in *pl.* 21, *fig.* 6, where the right side gives the profile of the cup and leaves, whilst the left is a perspective view of the entire decoration. A is the under view of a diagonal half of the capital, exhibiting in the same manner the profile and perspective. The breadth of the ground plan is determined by a square whose diagonal = 4 modules. On the sides of the square construct equilateral triangles. The concavity of the abacus is then determined by the arch constructed from the apex of such a triangle with one of its sides for radius. The distribution of the leaves and other ornaments is seen from the ground plan; their respective heights and curves are given in the scale near the elevation; and finally, the projection of the leaves and volutes, is determined by a straight line drawn from the astragal to

the point of the abacus, which must touch the extreme points of projection of all these parts. The single parts of the capital are as follows: *a*, cyma of the abacus, the truncated corners are termed the horns of the abacus; *b*, slab of the abacus; *c*, volute; *d*, pedicle with small leaves; *e*, large leaves; *f*, small leaves resting on the astragal.

The Corinthian capital admits of multifarious decorations, and we meet with ornaments of olive leaves, laurel leaves, parsley, acanthus, palm-leaves, and even of ostrich feathers. Various kinds of Corinthian capitals are shown on *pl.* 19: *fig.* 9, from the Tower of the Winds; *fig.* 10, from the monument of Lysicrates in Athens; *fig.* 11, from the Palace of the Cæsars, or the Temple of Peace; *fig.* 12, from that of Jupiter Stator; and *fig.* 13, from the portico of the Pantheon in Rome. The base also is richly ornamented. Sometimes the flutings do not extend to the foot of the shaft, but the latter is surrounded below by a rich ornament. *Pl.* 19 shows examples of this. *Fig.* 22 is the foot of a column from the Baths in Nismes, and *fig.* 23, the richly decorated foot of a column from the Basilica St. Praxeas in Rome, executed, however, in a style which we will not advocate, as it borders on the meretricious and does not harmonize with the slenderness of the shaft.

5. The Composite Order. It was long a question whether the Composite order should be regarded as a peculiar one, distinctly different from the Corinthian, or whether, as was the case with the Ionic and Corinthian orders of the Greeks, both had the same entablature, and were only distinguished from each other by the capitals. Palladio and Scamozzi, however, classed those monuments which had that peculiar capital differing so essentially from the various Corinthian capitals, and which had originated in a combination of the Ionic and Corinthian orders, as a peculiar order, which they called the "Roman," and which later received the much more expressive title "Composite," or combined order, and these architects invented also an entablature peculiar to it. Vignola has, beyond dispute, succeeded best in seizing the real character of the Composite order, and in giving it a regularity or peculiarity more prominent than that which his predecessors had allotted to it. The chief dimensions, that is, the heights of the columns and capitals, the height of the entablature in its chief parts, the intercolumniations, and the arcades, agree entirely with the Corinthian order. On the other hand the proportions and arrangements of the single members and their decoration in many places are very different, as an attentive consideration of the drawings will show. *Pl.* 21, *fig.* 9, shows the simple arrangement of the columns in this order; *pl.* 23, *fig.* 8, the columnar arrangement of the same with arches; and *fig.* 9, the columnar arrangement upon pedestals and with arches. *Pl.* 22, *fig.* 8, gives the view of the pedestals and of the lower part of the shaft of this order, with a half upper view of the same parts, and at A, the impost cornice and the archivolt of the arch, which, considered from without inwards, consists of a supercilium, cyma, cavetto, socle, stripe, bell-moulding, and a fillet. *Pl.* 22, *fig.* 9, shows the capital and the upper part of the shaft with indications of the reduction and the entablature, of whose cornice the under view is given in A. It will be seen from the drawing that the Composite

order has no modillions; but on the other hand the remaining members, with the exception of the height of the corona, are much more boldly profiled, especially the dentals. The construction of the Composite capital is illustrated in *pl.* 21, *fig.* 8. The ground plan, A, and the elevation are drawn according to the accompanying measures in the manner described with regard to the Corinthian capital. The sole difference is this, that instead of the flower stalk with the little leaves and volutes, large volutes are here employed as in the Ionic capital, having their groove, border, and the echinus, with the serpent's eggs and tongues or arrow heads between them. The projection of the rows of leaves and of the volutes upon the capital is determined by the oblique line from the astragal to the horn of the abacus. The leaves thereby obtain a much inferior projection, as, on account of the height of the volutes, the leaf-coronals must be lower, for which reason the Composite capital often appears heavy and overladen. The frieze of this order, and indeed a great many of the members, admit of a rich decoration, and the capitals especially have at all times been fancifully ornamented. As examples of such capitals we give in *pl.* 19, *fig.* 15, the Composite capital from the great hall of the Baths of Diocletian, and *fig.* 14, a capital from the church San Pietro in Albano. The construction of the attic base, and the scotia belonging to it, which are employed in this order, are represented in *pl.* 20, *figs.* 13 and 14.

6. The Balusters. The Balustrades, or Balusters, which were sometimes introduced between the columns, or in the attics of the new buildings, were constructed simply or richly according to the orders, and for the sake of completeness we have included the balusters according to Vignola in our illustrations, although they are now very rarely or never introduced. The design for the balusters must include that for the pedestal, which consists of the plinth extending under the balusters, of the cubes supplying the places of balusters, and of the cornice extending over all the balusters. *Pl.* 20, *fig.* 19, are balusters and pedestals for the Tuscan order, in which the latter receive decorations of rustic work or bossage. *Fig.* 17 is a baluster for the Doric order; *fig.* 18 for the Ionic; and *fig.* 19, for the Corinthian and Composite. It will be seen that the balusters and pedestals agree with the orders in the symmetry, slimness, and richness of the members. At present iron balusters are much more common than those of heavy stone, as in the former greater lightness and more elegance are attained.

7. Reduction and Torsion of the Shaft of the Column. Columns are reduced in various ways. Although in the majority, and the most beautiful of antique monuments, this reduction is achieved by a straight line from the foot to the neck, yet there are many such buildings in which this is not the case, but whose columns are either cylindrical for a certain distance upwards, and then begin to diminish, or in which the greatest strength is not at the base but a little way up the column, which is there somewhat swelled. We will here mention the two most usual ways of drawing the reduction. When the height of the column and its diameters at the base and the capital have been determined, make the column (*fig.* 10) cylindrical up to a third of its height, construct a semicircle upon the diameter

of the column, and let fall a perpendicular line from the top of the shaft upon this diameter, which will intersect the semicircle in some point; divide the arc thus obtained into any number of equal parts, and the upper two thirds of the shaft into as many equal horizontal stripes. If, then, perpendiculars are erected on the various points of the arc, and prolonged until they strike the horizontal lines in the shaft, the points of intersection will mark the diameters of the reduced stripes. The other kind of reduction is that of a swelling of the column, that is, a reduction upwards and downwards. After the proper diameter of the column (*fig.* 11) and the height of the column are determined, give this diameter to the shaft at one third of its height, and erect at its extremities perpendiculars extending to the base and to the astragal. Prolong the diameter at one third the height, sideways, giving it the length of two thirds the height, and half a diameter. Connect the highest and lowest points of the shaft, by straight lines, with the end of the prolonged diameter. From the axis of the shaft mark off on these lines half the length of a diameter, when the points thus obtained will be those of the upper and lower reductions. From the apex of the triangle formed by the two lines and the axis of the shaft, lines may then be drawn at will to any number of points on the axis, and semi-diameters marked off on the same, when all the points thus obtained will lie in the curve of reduction. The French architect, Blondel, regards the first conchoid of Nicomedes as the curve of reduction, and gives an instrument to draw this conchoid.

The twisted columns found in the altar of St. Peter's at Rome, in the church Val de Grace in Paris, and elsewhere, can only be regarded as abortive creations of a sickly fancy, and as exhibitions of a vicious style. In the former the chevalier Bernini sinned against good taste, and Le Duc imitated him in the latter. We give here the construction of such columns in order to show what trouble is taken to accomplish a paltry result (*pl.* 20, *fig.* 12). To draw the twisted column you must first make the ground plan (*fig.* 13) where the smaller circle indicates the cylinder of the column. Divide this circle into eight parts, and from all the points draw parallels with the axis of the column. The axis of the column you divide by horizontals into as many times eight parts as the column has twists (generally six, consequently into forty-eight parts). The points of intersection of these lines and of those which were drawn parallel with the axis from the smaller circle will then mark the course of a twisted line, which rests upon the small cylinder. From the points thus obtained mark off half the diameter of the column outwards, when the terminal points of these horizontals will mark the exterior contour of the spiral.

8. Doors and Windows. We have already stated (p. 29) that the doors and windows must harmonize with the cornices and members of the order, and for this reason Vignola has sketched especial doors for each order, although their form and size are always dependent upon the general relations and particularly upon the size of the building itself. The Tuscan door is very simple, twice as high as broad, and framed with a cavetto and socle, while the lintel, whose upper surface is curved, and the jambs are adorned

with rustic work. By rustic work we understand that kind of freestone masonry in which the several courses of the stones are distinctly marked by sunk joints or grooves, either chamfered or otherwise cut. The faces admit of great variety of treatment; and, quite contrary to what its name literally imports, the rustic work is frequently made to show the very reverse of careless rudeness, namely, studied ornamentation by means of highly finished moulded joints; and even when the faces are *vermiculated*, or otherwise made rough, it is apparent that it is done purposely or artificially, especially when the vermiculation appears in panels surrounded by smooth borders.

Vignola gives the same proportions to the Doric door as to the Tuscan, but lays it in a smooth wall and gives it a richer frame adorned with two stripes. Larger and especially magnificent doors are laid between columns, and receive a completed Doric entablature, surmounted sometimes by a balcony railing in place of an attic. As an example of such a door Vignola adduces the gateway which he drew for the Palace of the Cancellaria for Cardinal Farnese in Rome (*pl.* 20, *fig.* 15). This palace was of stones which were taken partly from the Coliseum, partly from the Arch of Gordianus, and was built by Bramante for Cardinal Rafael Riario, but completed by Vignola. Gates must always bear the character of the buildings to which they belong. The door for the Ionic order has a richer frame and a cornice similar to the Ionic entablature, and resting on consoles (hyperthyrum). A very beautiful example of such doors in ancient times is the newly discovered door of the Erectheum upon the Acropolis of Athens. The Corinthian and Composite orders have doors which are richly adorned and finished with a cornice with modillions. The height is rather more than double the breadth. An example of this door is that of the church San Lorenzo in Damaso at Rome (*fig.* 14). This church, also, Bramante undertook at the instance of the Cardinal Riario, but Vignola completed it, for which reason the doors were designed by him.

The windows have the same proportions as the doors, inasmuch as, with few exceptions, they are twice as high as broad. If they are arched above, their height exceeds double the breadth, but not by the full height of the arch. The windows have also frames which agree with the style of the building, and cornices sometimes resting upon consoles. Formerly they had triangular or arched gables over this cornice, but that error is now avoided. Sometimes the windows receive lower cornices with mouldings, and often resting on consoles.

8. Monuments of the Gauls and Britons (Celts).

We come now to a series of monuments, which, while the antiquities of Egypt, Greece, and Rome were studied with an untiring zeal, remained unnoticed and unknown; partly, perhaps, because they lay so near, and in part because they had no artistic value. We mean the monuments of our own ancestors, the Druidical and Celtic remains, which strongly remind us of the Cyclopean remains of Greece. The Celtic, Druidical, Gallic, and British

monuments consist mainly of single or several blocks of stone, put together with rude strength, and bear witness of the time when all finer cultivation was unknown to the people who erected them. From them to the period of an enlightened architecture there is one immense bound, for there was no gradual advance among those people who received from the Romans and other strangers who came and settled among them their culture and art, all complete. If, then, we wish to examine the style of building peculiar to these people, we must go back to the most remote antiquity, and begin with single stones.

The use of rough stones as monuments is traceable to the earliest times, but they had a lofty purpose, for among more than one people they were honored as the symbol of the divinity. In almost all countries of the world such idol-stones are found, which were the objects of the worship of the early races of those lands. The north, especially, abounds in them. England, Scotland, the Hebrides and the Orkneys, Germany, Hungary, Sweden, Denmark, Russia, Siberia as far as Kamtschatka, offer specimens of them, as well as Tartary, Thrace, Greece, China, and the coasts of Africa. Even in the new world they occur.

The Celtic monuments, so far as we know them, seem to have all served either for worship or sepulture. Only a very few appear to have been devoted to domestic purposes, and we shall presently endeavor to discover the intent of a number of them.

A chronological order in the description of these monuments might be difficult to follow, for though some savans have sought to do this, yet they have no authority for their work, and the only point that can be taken for granted is, that none of these monuments were erected after the invasion of the Romans into those countries. All are of Druidical origin, and the Druidical worship was everywhere suppressed by the religion of the conquerors. Of course these remarks do not apply to the mounds, for they were nothing but burial-places, at which there was no further worship than that of memory. In our description we must necessarily employ the Celtic names, so long as no other nomenclature exists, except our translation of these names.

1. Men-hir or Peulvans. An upright perpendicular stone, standing by itself, consecrated to prayer or to remembrance, was called men-hir (long stone) or peulvan (stone pillar), or finally, men-sash (straight stone). In England it is called stone-henge, from stone and henged or hung up, floating; and this generic name is now the peculiar title of the greatest Celtic monument in England, situated in Wiltshire. The men-hir, the simplest and the most numerous of the Celtic monuments, seem to have had very various purposes. Merely human purposes they subserved in only two ways, as boundary stones, and as monuments of great recollections. In religious ways the men-hir served partly as symbols of the divinity, partly as monuments upon the graves of heroes, for three or four men-hir indicated the grave of a chieftain. The excavations among the sepulchral monuments reveal bones, weapons, boars' tusks, antlers of deer, &c. If the men-hir was only the memorial of some important event, there are only weapons there; if

there is nothing found, it was only a boundary stone. Very often there are popular interpretations of the intent of the monuments. Thus, the men-hir of Guenezan in France, is called men-cam (the stone of crime); that of Brenantes near Plouaret, bren-an-tec'h (princes' flight). Often the whole region where it stands has a special name, as ker-brezel (place of victory), ker-laouenan (place of joy), &c. &c.

The height of the men-hir varies between 9 and 30 feet, and sometimes the thinner part of the stone stands in the earth. One of the largest men-hir lies in ruins near the great dolmen which is known by the name of the Merchant's Table, and of which we shall presently say something more. This men-hir was once 65 feet long, and there are few Egyptian obelisks of greater length. Men-hir are sometimes discovered with inscriptions upon them, as, for example, that near Joinville, which bears the Roman inscription, "VIROMARUS ISTATILI F" (Viromar, son of Istatilus), or with huge sculptures, as on the Maiden Stone near the town of Brecknock, in Wales, which represent the figures of a man and a woman. These ornaments, however, are unquestionably of a later date, as the original men-hir were wholly constructed of rough stones. When Christianity gradually supplanted Druidism these monuments were zealously destroyed, and there are yet extant old edicts of the kings Chilperich, Childebert (554), Edgar of England (967), whereby all who did not assist in the destruction of the idolatrous stones were threatened with slavery and the scourge. Afterwards, they were wiser, and instead of destroying these stones before which the people were accustomed to pray, they consecrated them to the true God. And they even erected new stones, upon which, as on the men-hir on the Judgment-hill of Carnac in Bretagne (*pl.* 24, *fig.* 1), they engraved the form of the cross, or they shaped the stones themselves into the cross, or wrought Christian sculptures upon the old men-hir that yet remained. Very probably the wayside shrines, so common in Southern Germany and all Catholic countries, arose from the men-hir.

2. Dolmen or Tolmen, Triliths. Dolmen (raised stone, devil's table, witches' table) are monuments which consist of several stones, and which support one or more flat ones like the top of a table. The word dolmen is Celtic, and consists of man (stone) and taol (table), which afterwards was corrupted into tol or doll.

The Dolmen are of three forms. The simplest are those which we will distinguish by the name Half Dolmen, and which seem to be incomplete. They consist of a long stone with one end upon the ground while the other is supported by an upright stone. An example is the Half Dolmen of Kerland near Carnac (*fig.* 2), upon which a cross was erected when it was changed into a Christian monument. Sometimes the Half Dolmen are only apparently so because the other supporting stone has fallen. Generally the flat top is 10—12 feet long, 5—7 feet high, and 2—3 feet thick. The supporting stones are seldom more than 3 feet high; if they are higher the monument is called Lichaven or Trilith. These monuments are rare. A very beautiful specimen is in the neighborhood of St. Nazaire (department of the lower Loire), consisting of a single stone, 3.26 metres long, 1.64

metres broad, and 0.34 metres thick, whose supports are 2.27 metres high (*fig.* 5). Strabo mentions in his Egyptian journey, Triliths dedicated to Mercury.

The real Dolmen may be either simple or complicated. The simple Dolmen consists of four stones, three of which form a rectangular grotto of which the fourth side is open, and upon which the fourth stone forms the ceiling. Of this kind is the Dolmen of Trie (*pl.* 24, *fig.* 3), in which, in the rear stone, there is a circular hole of which we have no explanation. The top is usually 18—20 feet in length, 12—14 in breadth, and 1½—3 feet in thickness.

Besides these there are Dolmen which consist of a greater number of stones, of which several stand upright and support the top, while others simply serve to fill up the intervening space. Sometimes the top itself consists of several stones. One of the finest of this kind is the Dolmen of Locmariaquer in Bretagne (*fig.* 10), known by the names of Cæsar's table, table of the merchants, and Dolvarchant. The top is more than 25 feet long, 13 feet broad, and 3 feet thick, and rests upon only three of the numerous stones that formed the wall, and of which some are pushed aside. This Dolmen stands east and west. In England also there are many such Dolmen, especially in the southern counties, and there are some there which are closed up on all sides.

If we return to the original intention of such Dolmen, we should find it, without doubt, to be religious, even if we did not find some of them mentioned by old authors as "Sanctuaries of Mercury." Tacitus says, speaking of Anglesea, the centre of Druidism in England, that in those forests there were altars upon which the blood of captives was burned or rather evaporated, and the Dolmen are such Celtic altars, for upon the majority of them there is a circular depression in which, probably, the blood of the victim was received and thence flowed away through a groove. In Cornwall there is still such a slab 35 feet in length, 19 feet in breadth, and 15 feet in thickness, which is laid over two natural rocks, and in which there are several such depressions, the largest of which is more than 6 feet in diameter. Some have supposed these depressions to be the work of chance, but more than two hundred monuments of the kind remain, and it is not likely that the same chance would have affected all of them.

3. Covered Ways. Covered ways, witches' grottoes, witches' rocks, are properly nothing more than large Dolmen, and are classed by antiquarians with them. These passages are frequently not of the same breadth for the whole distance, but are broader at one end than at the other, and many seem like passages leading to a square or circular hall, in which is a kind of subdivision into three or four compartments. The most remarkable monument of this kind, as well for its preservation as its size, and the immense blocks of which its walls consist, is the famous Witch's Grotto in the neighborhood of Saumur, on the road to Bagneux. *Pl.* 24, *fig.* 13, gives the exterior, and *fig.* 14 the interior view. The monument is well preserved and surrounded with trees. The entrance of the grotto, which, however, is now closed by a door, lies toward the south-east, and is formed by two stones

standing the usual width of a door apart. These stones, as well as all those which serve to support the upper slabs, are about 7 feet high, and their thickness varies from 7 inches to 1 foot 9 inches. The exterior breadth of the monument is nearly 15 feet, and the long sides are each composed of four stones, together about 52 feet in length. In the rear a single stone 21 feet long, extending far beyond both side walls, forms the end. All the stones, excepting the two front ones, which form the door and stand perpendicularly, are inclined inwards at the top. The ceiling consists of four stones, the largest of which is 22 feet long, 19 feet broad, and 3 feet thick. This slab is rent lengthwise, and is supported by an upright stone in the centre. Near Essé, a place not far from Rennes, is a similar grotto, which is more than 57 feet long and is divided into two chambers. *Fig.* 11 represents the exterior view. Of the two chambers one is much the smaller and serves as a kind of vestibule, and is about 13¼ feet long and 8 feet broad, entirely open in front and lying towards the south-east. A passage between two stones leads into the chief grotto, which is broader than the first room, being 11 feet in front and 12 in the rear. On one of the walls, which is only a continuation of the wall of the first room, the stones project on the inside, forming as it were small chapels. The rear wall of the grotto consists of a single stone, and the ceiling of nine slabs, some of which are six feet thick.

Near Tours is a similar monument called the Grotte des Fées, and represented in *fig.* 12. The entrance is towards the west, and the grotto is inclosed by 12 rough stones. One fourth of its length is partitioned off by an upright stone, leaving only a passage or door free, and thus a kind of vestibule is formed. The top consists of three stones, the middle one of which is 6 feet thick, that is twice as thick as the other two. The whole length of the monument is 22½ feet, its breadth 11 feet, and its height inside 7½ and on the outside on the centre top slab 13½ feet. Although rough, the stones are more carefully joined than was generally the case with such monuments. There are similar grottoes in France and England; for instance, near Locmariaquer, near Ville-Genvin, and upon the island of Anglesea; also in the province of Münster in Prussia.

A very peculiar monument, somewhat resembling the covered ways, is the double dolmen in a wood upon the island of Anglesea (*pl.* 24, *fig.* 4). Two slightly inclined dolmen stand close behind each other, one resting upon four, the other upon three supports. The top of the larger is about 14 feet long, 12 feet broad, and 2½ feet thick. The largest supporting stones are about 5 feet high. There is also a very rare monument in the department of Morbihan, bearing the same relation to the covered ways as the half dolmen to the dolmen. It consists (*fig.* 9) of a row of upright stones, against which another row leans obliquely, and the monument thus appears like a row of half dolmen placed closely together.

Much has been said of the object of these covered ways, and it has not yet been explained. The simplest and most natural idea seems to be, that the platforms of these ways, like that of the dolmen, were devoted to sacrifices celebrated in the presence of the people, while the covered room under-

neath served for the celebration of mysteries, which only the initiated were allowed to witness. They may also have served as dwellings for the priests, as would appear from their subdivision into chambers.

4. Natural Altars. We have considered the dolmen and the covered ways as sacrificial altars, but there were still others which were arranged with less labor, for nature herself erected them. Greater or smaller blocks of stone that lay upon the ground, either brought by men's hands or found there, were consecrated to the gods of the Druids, and used as sacrificial altars. Such is the Druid altar between Brelevenez and Cleder (Finisterre) (*fig.* 6), which is nothing but a great stone of 216 cubic feet in size and brought to the spot by men. Upon its top is a square basin of some 14 inches in breadth and 4 inches in depth, made with a chisel, or some similar instrument. From this basin a conduit leads obliquely off on one side. Upon the rim of the basin some runes are cut. Near the stone stands one of the rude stone crosses by which the first Christians consecrated these altars to obliterate the remembrance of the bloody gods of their ancestors. In England there are many such natural altars.

5. Pierced Stones. In France and more frequently in England, and especially in Wales and Cornwall, there are large upright stone slabs which are bored through from one side to the other. They are supposed to have been connected with the Druidical worship. Healing power is also said to have been attributed to them, the diseased limb having been put through the hole, amid mysterious ceremonies, with a confident anticipation of cure. A similar superstition in France lends force to this hypothesis, and recently such a stone was removed because the peasants were so credulous that they thrust their ailing legs and arms through the hole and firmly believed that they would be healed. There is a similar stone near Duneau in the neighborhood of Conerets, in the department of Sarthe, and we have represented it in *pl.* 24, *fig.* 18, at the left. The stone is about 10 feet high, 6 feet broad, and 3 feet thick, and a bough of a neighboring tree has now pushed itself through the hole.

6. Rocking Stones. The rocking stones must be classed among the most remarkable of the Celtic monuments. They are found in many places both in France and England. As their name implies, these monuments consist of huge stones which stand resting on a point in such a manner, either upon the ground or upon other stones, that the slightest touch puts them in motion. As this phenomenon may readily arise from natural causes, it would be wrong to suppose all such stones Druidical monuments. Thus the famous rocking stone near Huelgoet (Finisterre) is certainly nothing else than a rock fallen upon another and happening to balance there. Still in many instances it is impossible to deny the human agency.

The question as to the object of these rocking stones is answered very variously, but unsatisfactorily. One writer thinks that they were arranged with such care and skill only to show how much was then known of the laws of equilibrium. Perhaps these stones, floating as it were in the air, were to represent the world in space, or were a symbol of the power which moves

the universe so easily, or a symbol of the vitality that pervades the universe. Dulaur finds some affinity between these stones and those carried about by the Romish priests during drought to attract rain, holding that the stones were moved with a view to occasion favorable weather or to drive away magic. Baudoin makes of them the test of female virtue, because the stones in many parts of Bretagne, for instance near Jaudet, are called Roc'h-werc'het (Roche aux vierges). Only the true and chaste could put the stone in motion.

These rocking monoliths are found in all parts of France and England. The largest is that of Perros-Guyrech (Côte du Nord), being about 43 feet long and broad, and 21 feet high (*pl.* 24, *fig.* 8). The surface is flattened by nature and has a kind of hollowing, from which a channel is chiselled, so that it seems as if this enigmatical stone may have served as a Dolmen. The balance is so delicate that a single man can easily move this mass of rock, weighing not less than 1,000,000 pounds. In Bretagne there are several such stones; for instance, near Autun where a granite block, with an egg-shaped top, stands upon another granite block, in such a manner that it moves with the lightest touch. We cannot here mention all, but must not omit that near West Hoadley in the county of Sussex (*fig.* 7), which is about 22 feet high. It has a pyramidal base which rests upon a granite rock, and it is very easily moved. It is computed at 500 tons in weight.

7. Mounds. We have before mentioned that the simplest sepulchral monument was the upright stone (Men-hir), but distinguished persons received more important monuments. In the most ancient times no other than material greatness was recognised; immense mounds were, therefore, erected as sepulchral remembrances to great men, and the largest pyramids are perhaps nothing but mounds in their highest perfection. This custom of erecting mounds is traced to the earliest times. Herodotus and Homer often mention them, and the Germans of the present day are familiar with the Giants' graves, which popular tradition designates as the graves of a Titanic race of men who lived thousands of years ago. The Etrurian graves also, the grottoes of Corneto (p. 36, *pl.* 8, *figs.* 3 and 4, and Division IV. *pl.* 11, *fig.* 1), are nothing but such mounds, as we shall presently describe, but walled with stone. Pallas found the mounds in the north of Asia among the Tschuwashi, Ostiaks, Baltyri, and Samoyedes. Baron Tott found them in Tartary; Volney in the Pashalic of Aleppo as high as 90 feet; Bertram among the savages in Florida. In all parts of America, even among the Botocudi and in French Guyana, the dead are even now buried in an upright posture with their arms, and huge mounds erected over the graves. The Celts called the mounds, if they were constructed of heaped up stones, Galgals (from gal, a stone), and the Britons Cairns.

The dimensions of the mounds are very various, for there are some of immense size, and again others scarcely three feet in height. The round mounds have an almost semi-spherical form, and of this kind are most of the mounds in England, generally surrounded with a little ditch. The broad mound is similar to the round, but with the horizontal diameter much

greater, for there are those mentioned, not over 18 feet high, whose diameters are 90, 150, and even 220 feet. The oblong mound resembles the long in shape, and the long diameter is often three to five times greater than the short. There are rarely many of the oblong mounds in a line, but often an oblong one surrounded by several smaller round ones. The broad and oblong mounds are often galgals, and contain covered galleries leading to tomb-chambers. The little conical mounds were formerly very common in England, but have now mostly disappeared under the ploughshare, and they are, therefore, now only found in the uncultivated districts. Their diameter is rarely more than 30 feet, and they are often surrounded by a little ditch.

The twin mounds consist of two mounds in close contact, and possibly inclosed two persons who had been intimate friends. The bell-shaped mounds are found in the neighborhood of Stonehenge, and are probably of more recent date than the others we have mentioned. The mounds, however, must not be confounded with the artificial hills, which were often thrown up to mark the position of boundaries or places of execution, and which were distinguished by being always flattened upon the summit.

The mounds occur partly single, partly in groups. The former are the more common. To these belong, for instance, the mound of Salisbury in Wiltshire (*pl.* 24, *fig.* 15). It is of great dimensions, and is considered to be the grave of a king. Its circumference near the ground is 2300 feet, and its perpendicular height about 190 feet. The great number of mounds which surround it at some distance, are supposed to be the graves of important persons buried in the vicinity of the king. The largest mound in France is in the neighborhood of Sarzeau (Morbihan), near the sea, and is known under the name of Butte de Tumiac. It is about 100 feet high, and 400 feet in circumference; it is entirely overgrown with shrubbery, and serves the mariners as a landmark, as it can be discerned far at sea. Near Locmariaquer there is an oblong stone mound. The Mont St. Michel, too, near Carnac (Morbihan) is nothing but a mound erected upon a plateau, upon whose summit a chapel is built, dedicated to the archangel.

Near Pornic, in the department of the Lower Loire, there are several mounds situated in the middle of a plain. One of them has on the north-east side an opening leading to two low galleries of from 2 to 4¾ feet in width, by a height of about 5 feet. Their length has not yet been traced beyond 7 feet. The diameter of the mound itself, which is a galgal of quartz and calcareous slate, is 75 to 80 feet. Of the other mounds, one has been entirely dug through, and is therefore the most interesting of the group. In it are likewise found the entrances of two galleries (*fig.* 16) consisting of large rough stones, and forming several spacious halls in the interior of the mound.

In digging up a mound near Fontenay le Marmion, the galleries were found closed above with quarried stones, but the rooms in the interior empty. After digging through a layer of clay, however, which formed the floor, a mass of human bones was discovered, some of which showed traces of fire, whilst others were entirely uninjured. There were found ten

different graves, each of which had its gallery leading to a round space which had been the place of burial. There were no objects of metal found in the mounds, but a hatchet of stone, and a number of vases of black earth of peculiar form, and apparently made by hand alone without the assistance of a potter's wheel, from which their extreme age may be inferred. In other mounds also, hatchets of flint have been found together with vases of burnt clay (some of them containing well preserved nuts and acorns), small cutting instruments of stone, spoons made of burnt clay or of shells, a dish exhibiting rude drawings, boars' tusks, &c., but nowhere objects of metal.

In the Orkney islands some remarkable mounds have been examined, and only in the Orkneys, have mounds been found that contained two tiers of tombs. *Fig.* 17 gives the section of such a mound containing five tombs irregularly distributed throughout the mound, and having no connexion with each other. The mounds of the Orkneys are the only ones in which objects of metal, combs, glass beads, armlets, arms, &c., have been found.

The Gallic tombs of common people deserve especial mention in this place. They consist of an area inclosed by four upright stone slabs, never sunk more than three feet under the surface of the ground, and covered with a rough block. They are sometimes found by hundreds in a limited area, and such a spot is called *Carneilloux* (from *carn*, flesh chamber). They are met with frequently both in Bretagne and in England. The remains found in the same are generally surrounded by similar objects with those found in the mounds, and indicate the Celtic period. The architect, Gau, author of a large work on Nubia, found in 1839 a Gallic mound in the neighborhood of Gisors, in the department of Eure, consisting of six rough stones, leaned against each other in pairs, and forming a kind of gable roof over six skeletons (*fig.* 18, right hand).

8. Sacred Inclosures (Cromlechs). It is well known that the Greeks and Romans consecrated certain spots to the gods, setting them apart by inclosures. A similar custom is observed among the Celts, and according to Tacitus such places were held in such awe, that except the priest nobody dared enter them otherwise than with bound hands, this being considered as indicative of reverence to the Deity.

These inclosures were of multifarious forms, often very irregular; the most important ones are circular, and termed *Cromlechs.* They are among the most interesting Druidical monuments.

The inclosures were generally formed by earth walls, surrounded by a ditch. That of Kermurier (Morbihan) is of the shape of a horse-shoe, the opening closed by a straight line. One of the largest is near Begars (Côte du Nord). It forms an ellipse with a long axis of 3000 feet, running north and south. The semicircle at the northern end contains 12 huge stone blocks, 7 others lying along the axis. At the opposite extremity stands a men-hir, 25 feet high.

The cromlechs, or Druidical circles, which sometimes have been called astronomical circles, but without any reason, are bounded by upright stones. In France they are of rarer occurrence than the dolmen and men-hirs,

whilst in the British Islands they are more frequent. *Fig.* 19 represents one from the Orkney islands, somewhat over 300 feet in diameter, very well preserved, and also interesting on account of its picturesque situation. In the centre of the cromlechs was a men-hir as symbol of the Deity to which the inclosure was consecrated, and which was worshipped by the people. Sometimes dolmen are found near the sacred inclosures, but never within the same, as the sanctuary must not be desecrated by the blood of the victims.

Cromlechs have also been found in Germany. One of them situated near Helmstadt, in Brunswick, is very remarkable. It has in the centre a men-hir standing between two triliths, which arrangement seems to corroborate the view that the triliths were merely dedicatory, not sacrificial altars, since, as we have seen, dolmen proper never occur within the circle of the inclosure. In Switzerland, where no other Druidical monuments are found, a cromlech occurs in the picturesque district of Hasli.

In England there are two monuments of this kind, but more complicated in character. The more important one is Stonehenge, in Wiltshire. It consists of a double inclosure of upright stones about 28 feet high and 7 feet broad. These stones are rudely hewn into quadrangular form, and surmounted by a kind of architrave of more carefully wrought stones mortised on their supports. The outer circle is about 190 feet in diameter. Within the double inclosure are two others of elliptical form, open on one side and containing each a men-hir standing alone in the centre. There can be no doubt that the group was a cromlech dedicated to some powerful deity, although some archæologists designate it as the ruin of some substructure.

It will be proper to insert here, before passing to the period of the Middle Ages, some remarks on the architecture of China and America, neither of which can be grouped in any of the chronological periods of architecture, the former having had no ancient, and the latter having no modern architecture of its own, as will appear from our sketch of the monuments of these countries.

9. Chinese Architecture.

China is essentially the country of stagnation. Hundreds of inventions, made by other people in later centuries, have been known to the Chinese often for thousands of years; but at a certain point of development their progress has been arrested, and they have been gradually distanced by the development of the rest of the world so as now to be very far behind the general civilization. Their architecture of the present day is exactly what it has been time out of mind, and this suggested the foregoing remark that they had no ancient architecture, as it is identical with the modern in every characteristic. The great Chinese wall bears witness to the early progress of art in China, whilst at the same time, in a measure, it is the cause of its arrest, since it is a barrier against the introduction of foreign improvement as well as against the

diffusion of the valuable part of Chinese knowledge through the rest of the world. For the description of this wall we refer to the division of this work devoted to military sciences, where it has been treated of under the head of Fortification. It was commenced about 270 years B. C., and shows in its gates the construction of regular semicircular vaults made of wedge-shaped stones carefully jointed. Much of it is executed in bound masonry, and this kind of construction is also found in the walls of cities in the interior, and in the palaces of the grandees, whilst the great mass of the buildings in the country are chiefly made of sun-dried bricks or of bamboo cane. With regard to the shape of the Chinese buildings, they have with characteristic stability preserved the tent form of the nomadic ages, which is met with in all descriptions of edifices: temples, palaces, and common dwellings.

The combination of framework in China is very simple. The ridge of the roof rests generally only on a couple of posts overtopped by a beam which supports other posts with a cross-beam, this arrangement being repeated until the requisite height is attained. Bamboo canes bent into the curve of the tent, recurved below, supply the place of rafters, and are connected by their cross-laths, which support the light glazed tiles. The latter are grey for common dwellings, green for princely residences, and yellow for the edifices of the emperor. The corners and ridges of the buildings are adorned partly with large foliated decorations, in part with fabulous animals among which the dragon is most prominent. Similar ornaments are placed on the ends of the architraves where they pierce through the wooden columns (*pl.* 25, *figs.* 6, 7). Under the entablature and between the columns there are generally trellised friezes (*figs.* 14, 15, showing at the same time the form of the roofs with the pavilions usually placed on the same). The gaudiest colors are used in the decorations of all buildings, especially green and gold. Yellow paint occurs only on imperial buildings, this color being interdicted to all but the emperor.

The ground plan of the buildings (*figs.* 1, 2) is generally so arranged that the street fronts are occupied by shops. Next follow the rooms of the family, mostly spacious halls, the Chinese being of a very sociable disposition, especially the female sex. The houses have no windows to the street, but always several large courts in the interior similar to those of the ancient Greek and Roman buildings, with which the Chinese structures have many surprising affinities in point of arrangement. The houses are generally inhabited by only one family, and are mostly only one story high. If there is a second story, it is placed some distance back from the front and has a piazza with columns before it, and a richly carved wooden railing like those represented in *figs.* 8—11. The columns placed in the yards, as well as those that support the far projecting roofs, have no reduction. Their bases are more or less ornamental (*figs.* 5—7), but they have no capitals, their tops being concealed in the roof. *Fig.* 3 gives the elevation, and *fig.* 4 the section of a Chinese house which exhibits the curious circular doors used even in the interior of the houses. The windows are generally fancifully carved and rather small (*fig.* 13). The walls have frequently trellis work, which

assists in ventilation, thus counterbalancing the smallness of the windows. The ceilings are panelled (*fig.* 12) and gaudily painted and gilded.

Fig. 16 gives a view of the rich dwelling of a mandarin. It is situated in Tong-Chow, and known as the Pavilion of the Star of Hope. It consists of three distinct buildings of magnificent workmanship, two of which are entirely open halls lying in front of the house, and forming, as it were, porticoes to the same. The roofs are all of different shapes and tastefully carved. The whole is surrounded by rich terraces and gardens. The interior corresponds in magnificence with the exterior, and is especially rich in carved and inlaid work. It is divided into two parts by a corridor filled with beautiful flowers and separating the rooms of the owner from those of the women. All sleeping rooms are in the upper story, which opens upon a terrace surrounded with a carved railing also decorated with flowers. The effect of the villa and its grounds is said to be truly enchanting.

Of public buildings the pagodas deserve special notice. *Fig.* 18 gives the ground plan, and *fig.* 19 the section of the large pagoda at Ho-Nang, the southern part of Canton. It is 572 feet in length by a breadth of 360 feet, and is used as a temple, a market, a tavern, and a hospital. The buildings in the circumference connected by colonnades contain the various apartments used for secular purposes, whilst the three edifices in the centre contain the temple and the dwellings for the priests. In the arrangements of the ground plan affinities to the Greek and still more to the Egyptian style of building are perceptible.

With the exception of Christian churches, which are not tolerated, we find in China temples for the public worship of almost all known religions: for instance of the religion of Confucius, Buddha, Mahomed, of the Hebrews, &c. Exteriorly the different temples are almost all alike, and they vary only in their interior arrangement. *Fig.* 20 represents the entrance of a magnificent temple of Confucius in Tsing-Hai in the province of Tshe-Kiang. This temple is one of the most frequented. The entrance represented in our figure leads to the sanctuary which, like all similar places in China, serves two purposes, first that of worship, and next of occasional residence for imperial officers or of distinguished travellers, who never omit to bestow upon the temple a donation in accordance with their rank or wealth. They also give presents to the priests, as they receive no salaries from the emperor, who only pays the priests of his household, leaving the others to the care of the devout.

One of the most renowned edifices of China is the porcelain tower of the Temple of Gratitude, near the city of Pekin, which was built by order of the emperor Yung-Lo. According to the report of the missionary P. Lecomte it has a substructure of brick forming a large platform, surrounded by a railing of rough marble, and accessible from all sides by flights of ten or twelve steps. The hall serving as temple has a depth of 100 feet, and rests on a plinth of marble one foot thick, and projecting two feet on all sides. The front has several pillars and a gallery; the roof is covered with green tiles. The woodwork in the interior consists of innumerable small

pieces joined together without any regular system, which is considered a merit by the Chinese, and is painted. The aspect of the forest of posts, pillar, beams, and ties, is indeed surprising; whilst it is evident that the waste of work originated only in the ignorance of the Chinese of the noble simplicity in construction and decoration which gives our modern buildings their strength and beauty. The principal hall is lighted through the large door on the east side. The tower standing at the side of the hall is octagonal, with a diameter of about 40 feet. Above the first story it has a glazed roof resting on columns, and having an elegant gallery. The whole consists of nine stories, divided by small roofs projecting under the windows about 3 feet, and gradually less towards the top. They have no galleries or columns. The walls of the tower are 12 feet in thickness below, gradually reduced to 8 feet at the top, and are faced with porcelain slabs, which have suffered considerably from rain and dust. The stairs in the interior are narrow and uncomfortable, the steps being very high. The stories are divided by strong beams supporting floors. The tower has thus nine chambers, whose walls are covered with the fantastic painting so characteristic of Chinese art. In the upper stories they have numerous small niches, in which idols are placed, which produce a singular effect. The walls seem to be faced with slabs of burnt clay, with bas-reliefs, and gilded throughout. The first story is higher than the others, which are all alike in height. The steps are 190 in number, each being 10 inches high. The whole height of the tower, including the substructure and the bell-shaped roof of the ninth story, is somewhat over 200 feet. The roof is very ornamental, and pierced by a mast, which commences in the eighth story and projects 30 feet above the top. It is surrounded by an iron spiral, wound at some distance from the wood, and its highest extremity carries a large gilded ball.

This structure is one of the strongest and most ingeniously executed among this kind of edifices, which are found in all parts of China, and known by the name of Ta.

10. American Architecture.

We have stated above that America has no modern architecture of her own. This view is based upon the examination of the monuments of a peculiar kind found in Central America and Mexico, and belonging to a much earlier period than the discovery of America, and probably dating even further back than the Christian era. The buildings erected on this continent at a later period and in our days bear no affinity whatever to the style of those monuments, but belong essentially to the European schools of art, modified to suit the convenience or taste of the builders. The monuments of antiquity must therefore be regarded as the only representatives of American architecture proper, and are therefore the only ones that claim our attention in this place, whilst we shall hereafter have occasion to mention several important edifices erected on this continent in modern times. A few stones with alleged Runic inscriptions found in the northern part of the United States (Rhode Island and Connecticut) have been designated by

antiquarians as the remains of buildings erected by the Danes, who had discovered America long before Columbus; but as this allegation is as yet totally without historical proof, and these stones without any architectural interest, they will not come within the province of our sketch.

When the Spaniards conquered Mexico they found a certain degree of civilization among the aborigines, which was the more surprising as it had been developed by no previous intercourse with other people. The division of labor was found to be carried to an incredible extent in the mechanic and finer arts. The artists as well as the craftsmen finished only a certain part of the work, and beyond its completion they had no knowledge whatever. They supplied by consummate skill and perseverance in their proper spheres the deficiency of their rude tools.

The civil and religious architecture of the aborigines is only known from the descriptions of the conquerors, since the few remains of the same afford too little scope for investigation at the present day. The dwellings of the poor were made of pebbles or sun-dried bricks, and covered by a net on which aloe leaves were fastened like tiles. The houses had only one room; only in the towns some were found that had two rooms and a bathing room.

The dwellings of the more wealthy were of a very porous red freestone laid in mortar, and had flat roofs with terraces. The palaces of the kings and the temples were of similar form, only larger.

The art of architecture had reached a good degree of development among the people of the plateau of Anahuac, and thence spread to the Aztecs, and other tribes with whom the Spaniards came into contact, and whom they found thoroughly acquainted with the arts of erecting perpendicular walls, of dressing stones, and of constructing vaults, whilst their aqueducts which supplied Tenochtitlan with drinking water, their dams, dykes, and highroads, sometimes carried through lakes, bore testimony to their practical skill.

The oldest edifices of which remains are still extant are the two pyramids of San Juan de Teotihuacan, in the valley of Mexico, known by the names of Sun and Moon. They were the prototypes of the great temple of Tenochtitlan. Their tops are accessible by immense flights of stairs of hewn stones, and there are still found fragments of altars which had their places there. These pyramids face the quarters of the heavens, and were formerly surrounded by several hundred smaller ones 90 to 120 feet in height, which were grouped all around the pyramids, and had streets between them leading to the faces of the large pyramids. The smaller pyramids were dedicated to the stars, and probably contained the tombs of the chieftains of the different tribes.

About sixty years ago the pyramid of Papantla (*pl.* 26, *fig.* 7) was discovered by chance in a dense forest near the pyramids of the Sun and Moon, which covers the slope of the Cordilleras, near the Gulf of Mexico. The aborigines had zealously kept the secret of the location of this pyramid, being very reluctant to discover the objects of their religious worship to the curiosity of the whites. This teocali (temple) is the highest as yet known, and consists of admirably hewn and jointed freestone. The structure, which has seven stories and is accessible by two flights of stairs, is

entirely covered with hieroglyphics. In all the stories are found quadrangular niches symmetrically arranged, and numbering in the aggregate, according to Alexander von Humboldt, 318, corresponding with the number of single signs constituting the calendar of the Toltecs.

The most important monument of the district of Anahuac is, however, the pyramid of Cholula, situated on a plateau 6700 feet above the level of the sea, and facing exactly the four quarters of the heavens. Its summit is accessible from all four sides, and its general arrangements have many affinities to those of the Egyptian pyramids. It is nine feet higher than the pyramid of Gizeh, and nearly twice as high as that of Cheops. It contained spacious vaults which served as burial-places, and on its platform, which measured 1050 square feet, stood in the times of the Aztecs an altar dedicated to the air, which the Spaniards replaced by the church Nuestra Dama de los Remedios, probably occupying a higher site than any other church.

A very curious monument is a temple at Xochicalco, near the town of Quernavaca, which is at the same time a kind of fortress (*fig.* 2). It consists of a natural rock, 360 feet high, wrought by hand into a tolerably accurate pyramidal shape, and surrounded by a ditch, thus forming a redoubt, or a fortified temple. Its summit has an area of about 2500 square feet, and is surrounded by a wall for the protection of the defenders. The regularity of the construction of this wall of porphyry is highly spoken of by travellers, as well as the clearness of the bas-reliefs which decorate it. Among the figures represented in the latter are crocodiles, and, what is very curious, human figures in the sitting posture of the East with crossed legs. Each figure covers several stones whose joints are so carefully closed as not to disturb the surfaces of the sculptures in the least.

The question whether there is any connexion between the Mexican pyramids and those of Egypt has not yet been decided. It is characteristic in the former that they always appear as huge substructures for temples or altars. The latter were always placed in the highest possible spots by the Mexicans, and where they did not find natural rocks in which they could cut stairs to gain access to the summit, they constructed artificial pyramids.

Traces of a well developed ancient architecture are also found in the district of Tlascala, situated between the territories of Mexico, Cholula, and Huexotzinco. The aborigines of this district had surrounded their capital with walls, and erected a thoroughly fortified camp, for which the nature of the ground afforded the best facilities. Its western extremity was closed by a deep ditch and high walls. On the eastern side was a wall of twenty-five miles in length, whilst the northern side was effectively protected by a number of strong positions in the chain of the Cordilleras. Within this inclosure the people asserted their independence from Mexico and worshipped the sun, whilst all around them a sanguinary worship had already been introduced. *Fig.* 1 gives the view of a bridge across the ditch which lay in the line of defence, from which it appears that the Tlascalans had only an imperfect knowledge of the art of constructing vaults, and that their method of construction was similar to that of the Cyclopean walls, which is the primitive architecture of all nations.

Among the oldest architectural remains of Mexico are the two pyramids of Teotihuacan (*fig.* 3) and of Tuzapan (*fig.* 6). In the neighborhood of these were twenty other such temples, of which but few traces are left. The former is erected on a quadrangular artificial rock with flights of stairs on all sides leading to the Cyclopean substructure of twelve steps which supported the temple proper. In the latter was found an idol of bronze; another of a large emerald, representing the god of war of the aborigines; and an image of the sun wrought of gold with rays of mother of pearl, with its mouth open and set with human teeth. On the platform were found several other idols made partly of jasper or porphyry, in part of wood, plaster, or colored stones. The second temple (*fig.* 6) was larger and higher than the former, and its pyramid constructed with great regularity of blocks of freestone. It was approached by only one flight of stairs remarkable for having distinct cheeks. In the sanctuary of this temple, which had an elaborate front, Don Martin d' Urfua found, in the year 1697, a bag suspended from a rope and containing bones. On his inquiry about them he was told that these were the bones of the favorite horse of Cortez, who, when returning to Mexico, after receiving the oath of allegiance of the inhabitants, had left his sick favorite to the care of the king of the tribe. The horse died, and the Indians, who feared that on the return of Cortez they would be held responsible for this calamity, made the bones of the horse the object of religious worship.

Another temple was dedicated to the king and his descendants, and its pyramid served as a burial-place for the latter. There were other temples, one of which belonged to the priests, the others to private individuals.

A description of the palace of Utatlan will give an idea of the arrangement of the royal residences as found by the Spaniards in Guatemala. It betrays a degree of civilization which would be incredible but for the unanimous testimony of eye-witnesses. The city of Utatlan lay on a plateau, whose declivities formed a natural ditch around the whole of its precincts, and it was only accessible by two narrow ways. In the centre of the city was the residence of the king surrounded by the palaces of the great. The number of inhabitants was so considerable that the king could oppose 72,000 warriors to the Spaniards. Among the edifices of the city, the seminary was remarkable, in which 6000 youths were lodged, clothed, and educated at the expense of the state by sixty teachers appointed for the purpose. The city was defended by two large royal castles capable of accommodating large garrisons, and by the residential palace, which was more magnificent than the one of Montezuma in Tenochtitlan, and that of the Inca of Cuzco. Its front lay due east and west, and was 376 steps in length, whilst both sides had 728 steps in depth. It was built of stones of various colors, and exhibited beautiful proportions. The interior was divided into seven subdivisions. The first was occupied by the body-guards of the king, consisting of archers and lancers. The second afforded residences to the princes and relatives of the king, who were there sumptuously provided for as long as they remained unmarried. The third division was the residence of the king himself, which

also contained the state treasury, the arsenal, and the offices of state. The fourth and fifth divisions were occupied by the wives of the king, every one having her own apartments, baths, garden, and every imaginable comfort. The sixth and seventh divisions were allotted respectively to the royal princes and princesses. No palace of modern times in any civilized country would bear a comparison with the sumptuous magnificence of this residence of the king of a comparatively savage nation.

Near Chiapas, on the frontier of Yucatan, the ruins of Palenque are of especial interest. The ruins of the palace, of which several walls are still standing, are not the only ones found there, but there are also ruins of a number of private houses from which the ground plan and interior arrangement of such buildings with these people can be seen, their extreme age notwithstanding. The disposition of the plans to these buildings, the sculptures, the painting, of which sufficient remains are left for investigation, and the grand forms and proportions exhibited throughout, force upon the beholder the conviction that these people were deficient neither in civilization nor in practical skill.

Of equal interest with the ruins of Palenque are those of Uxmal in Yucatan. They are the remains of a city which was once 16 miles in circumference, and are in better preservation than the ruins of Palenque. The name of this city cannot be given with certainty. It is supposed, however, to be the ancient Majapan. Among its ruins is one called the Dwarf's House, situated on the platform of a pyramid 224 feet in length and 120 feet broad, and containing three rooms. Its exterior is entirely covered with sculptures, which are both tastefully grouped and skilfully executed. Among the decorations are leopards' heads, foliated work, and a variety of rich panels; and the joints of the masonry are so admirably fitted that they in no instance mar the effect of the sculptures, although the figures often extend over four or five stones, the building being erected, like all American monuments, of much smaller blocks than were employed by the Egyptians in their edifices.

Another building is said to have been the residence of the virgins of the sun, and is therefore even now termed the House of the Nuns. It is situated on an artificial substructure 15 feet in height, and occupies a plot of ground 80 feet square. The principal entrance is wide, and leads into a spacious court. The walls of the buildings, both exteriorly and interiorly, are covered with sculptures, the interior being, however, much the richer in decoration. *Fig.* 8 shows part of the front facing the court, and exhibits the proportions of the cornices which were introduced in American architecture. The lower part of the front is smooth, the upper very rich in well executed sculptures, among which are full length figures drawn with ease and well proportioned. The middle of the front has two colossal intertwined serpents, whose heads rest on the centre cornice, and which have caused the occasional designation of the building as the Temple of the Two Serpents.

The house of the Tortoise probably destroyed by an earthquake, and the House of the Pigeons, the one named from its shape, the other from

numerous recesses in the front, deserve a passing notice, on account of the quaintness of their exterior, whilst their details are uninteresting.

The most important among the ruins is that of the residence of the sovereign, besides being in the best state of preservation. It stands on two pyramids placed one upon the other. The lower one is 600 steps in length and breadth, and has a platform planted with trees, and having several buildings on it. At the south-east corner of this platform there is a row of 18 small cylindrical pillars, occupying a space of about 100 feet in length. They are about 4 feet in height, by 18 inches in diameter, and their form seems to indicate that columns were not unknown to the people of those countries. On this platform rises the pyramid represented in *fig.* 4, on whose summit is the edifice termed the House of the Ruler, which is much in the same condition in which it was left by its former occupants. It is entirely of stone, without any ornament up to the main cornice. The latter, however, is decorated with surpassing richness, as may be inferred from our *fig.* 5, which represents the corner of the same, whilst *fig.* 5*b* gives the figure contained in the ornament on a somewhat larger scale. The proportions of this building exhibit a degree of symmetrical grandeur so thoroughly in accordance with the strictest rules of art, that it becomes difficult to credit that this is the work of a nation to whom the greatest ignorance in matters of art is usually attributed. Intelligent and veracious travellers class the ruins of Uxmal with the very best monuments of Egypt. A remarkable circumstance in the House of the Ruler is the fact, that whilst the whole structure is of stone, all the lintels are of iron wood 8 to 9 feet long, 18 to 20 inches broad, and 12 to 14 feet thick, and that they have been burdened unhesitatingly with the weight of a wall 12 to 16 feet high, and 4 feet thick. The only probable explanation of this circumstance is, that the wood has been introduced as a great curiosity of immense costliness, owing to its scarcity, and the difficulty attending its transportation to the spot. The floors and ceilings are constructed of quadrangular stone slabs. No trace of arching is found, and the interior of the rooms is entirely without decoration. An ornament often repeated in the sculptures of the cornice is a death's head, with large extended wings and projecting teeth (*fig.* 5, top). It is two feet broad, and anchored in the wall. Another prominent feature of the cornice is the mosaic-like sculpture visible at *a* (*fig.* 5), whose effect is very pleasing.

The opinions as to the period when these monuments were probably erected vary greatly. Lord Kingsborough dates the civilization of Central America from an alleged migration of the Jews before the Egyptian captivity. Dupaix holds the American monuments to be antediluvian. Stephens considers them to be of comparatively recent date, that is to say, little before the Christian era. Waldeck, however, is of opinion that the civilization of Guatemala which called forth these monuments is much more remote than the settlement of the Aztecs in Anahuac, and, indeed, the oldest traditions of the aborigines make mention of these structures, which therefore perhaps may be contemporary with those of Egypt.

II. THE ARCHITECTURE OF THE MIDDLE AGES.

In the history of the arts the middle ages comprise the period which begins with the introduction of the Christian religion, and ends with the second decline of art, or with the time when architecture had sunk so far below the point of development to which it had risen in the 13th and 14th centuries, that in the 16th century a complete regeneration of art (*renaissance*) became necessary, in order to rëestablish in the features of architecture a pure taste, which would make the buildings expressive of a revived sense of beauty. This period may conveniently be divided into two sections, the first embracing the time from Constantine the Great down to the 11th century; the second from that date down to the 16th century. We will introduce our descriptions of the prominent buildings of both sections by short historical sketches, tracing the progress of art in each.

1. The Period from Constantine the Great to the 11th Century.

The first Christians, it is well known, were the objects of the most violent persecutions, and accordingly held their religious meetings clandestinely, in the catacombs and similar secluded places, or they made places of worship of grottoes, which they widened or lined with walls. These subterranean churches were termed *crypts*. Constantine gave countenance to the new religion by embracing it himself, and henceforth it was publicly professed, and consequently a new era in architecture commenced, that of the Christian churches. At first it was very much under the influence of Roman architecture, which had already declined considerably. This was especially the case with that branch of the art which prevailed in the western part of the empire, Italy, Germany, France, &c., which was termed the style of the basilicas, or *Latin* or *Romanesque architecture*. The other branch originated in Constantinople, from the more oriental development of the Roman style, and was that peculiar and characteristic style known as the *modern Greek* or the *Byzantine architecture*. We shall examine the peculiarities of both these styles, adducing some prominent buildings of each as examples.

A. The Romanesque Style.

Having already stated the origin of the basilicas and the changes in their form and use since their introduction into Italy, from Greece, it remains for us now to examine the details a little more closely, showing at the same time how the heathen structures were adapted to the Christian worship.

1. The Ground Plan. Great irregularity prevailed for a long time with regard to the plans of basilicas. Constantine erected in Rome, Constantinople, and in Palestine, basilicas of all forms, round, polygonal, rectangular. An example of the last form is the church of St. Marcelline in Rome (*pl.* 27, *fig.* 1). Sometimes the plans showed a combination of several figures.

There are several examples of quadrangular basilicas with perfectly circular sanctuaries attached, for instance St. Martin's church in Tours (*fig.* 2), built by Perpetuus. When the rites of the Christian worship had been established, the rectangle was found the most convenient form for the basilica and was generally adopted in the west. It is shown in the ground plan of the basilica Santa Maria Maggiore in Rome (*fig.* 6). The side aisles were reserved for female worshippers, and were made accessible by special doors in front, placed at the sides of the main entrance leading to the principal nave, which ended in a semicircular choir similar to the tribunal of the heathen basilica. Behind the altar was a bench for the priests. In some basilicas similar choirs were attached to the side aisles, for instance in the church of Parenzo in Istria (*fig.* 3). The side choirs were closed by drapery, and served as receptacles for the vessels and books of the church. By degrees they were made of larger dimensions and became the treasuries and libraries of the churches.

Although this form of the basilicas answered all practical purposes, further changes were made in the course of time from various motives. First the sanctuary was separated from the rest of the church by a wall, parallel to which another was laid near the middle of the church. This was the first germ of the transepts and of the cross form which prevailed in the plans of churches for the succeeding centuries. It is illustrated by the plan of St. Paul's before the walls of Rome (*fig.* 4). The cross walls were interrupted by wide arches affording a free communication between all parts of the building. The church had in front a vestibule with columns, where the congregation assembled before the ceremonies, and where penitents and sinners waited the permission of entering the church. Such vestibules were also attached to the circular basilicas as in St. Stephen's in Rome (*fig.* 15).

The earliest Christian churches, especially those built by Constantine in Rome, had their entrance on the east side, the altar at the western extremity, the officiating priest looking towards the east when turned to the congregation. This arrangement was afterwards exactly reversed, and all the churches almost without any exception have their entrances at the western end, and the altar at the eastern.

2. The Elevation. The first churches had mostly the outward appearance of the Roman buildings of the age, and were probably very simply decorated. Afterwards they were adorned with mosaic work, gilding, marble fronts, and excellent sculptures. The outer wall of the central nave was usually carried much higher than the side aisles, and supported a gable roof with a rather simple cornice. The sides of the roof rested on the side walls with windows, through which the principal nave was lighted. In the gable was a circular opening, the eye, for admitting air under the roof. The place of the eye was afterwards taken up by mosaic work introduced in the gables. Sometimes there was no gable, the slope of the roof being laid in front, as in the church San Lorenzo before Rome (*fig.* 9). The gable form is shown in the view of St. Agnes' basilica near Rome (*fig.* 14).

The principal front below the gable or sloping roof was mostly decorated with mosaic compositions representing Christ, the Holy Virgin, the

Apostles, and even entire miracles. The front wall in the vestibule was subdivided by the main and side entrances, and its face also decorated with mosaic or painting.

The vestibule of the Romanesque church is a kind of portico, extending before the entire width of the front, and resting on columns, with antique bases, and shafts either smooth or with very narrow spiral flutings. The capitals are either Ionic or Corinthian, but vary occasionally from the original forms of those orders. The capitals are connected in pairs by architraves supporting a continuous frieze and cornice, the former often decorated with a mosaic of differently shaded marble, red and green porphyry, &c., whilst the latter is too gaudily set with modillions and foliation in a poor style. The vestibule has a straight slanting roof resting with its lower side on the cornice, whilst the upper is lodged in the wall of the basilica. The doors leading into the naves have generally very rich frames relieving materially the paintings on the walls between them. Sometimes a narrow portico supplies the place of the vestibule, as in St. Clement's basilica in Rome (*fig.* 17), when the door leading into the interior is always of surpassing splendor. In some basilicas there is neither this portico nor the vestibule which we have described, but a cross wall at a short distance from the front wall cuts off a piece of the interior, thus forming a species of inner vestibule which communicates with the main and side naves by three openings closed only with drapery.

The side fronts of most Romanesque basilicas offer few interesting points except the manner of construction, the roofs of the side aisles, and their connexion with the transept (*fig.* 16). The sides of the basilicas have usually a row of windows, with round arches above. In southern countries the place of windows is often supplied in the frames by thin slabs of marble pierced with circular or lozenge-shaped holes closed with glass (*figs.* 12, 13).

The rear view of the basilica (*fig.* 18) exhibits usually one or more semicircular attached buildings, the inclosures of the choirs. The central is always the largest, and has richer cornices. Windows occur but very rarely in the choirs. If the basilica has no transept the rear wall is profiled like the front, but if it is a cross basilica the roof line of the side aisles is horizontal (*pl.* 21, *fig.* 24). The semicircular choirs have conical roofs attached to the rear wall of the basilica.

3. The Interior. The oldest Christian basilicas had naves of different sizes, separated by two or four rows of columns parallel to the side walls. They were for a long time close imitations of the Roman heathen basilicas. In some the straight architrave is supplanted by arches, in others combined with them. In the latter case the side aisles have two stories, the upper one being formed by a gallery, as in that of San Lorenzo in Rome (*fig.* 10). This gallery was reserved for women, and had its own entrance from outside the basilica. Above were the windows through which the church was lighted. Towards the choir the walls had arched openings (*fig.* 11). The round wall of the choir being lower than the nave ample room was afforded in the straight rear wall for mosaic and paintings. The side walls above the galleries were also decorated in this manner. The

floors were inlaid with stone plates of various colors, and an excellent effect was attained by grouping the marble, granite, and porphyry plates in rich patterns.

The roof of the basilica was of simple, double, or triple suspension framework, according to the size of the main nave, and often without wainscoting, so that the rafters were visible in the interior. They were therefore painted with great elegance.

The altar in the oldest basilicas was of the shape of a quadrangular sarcophagus, emblematic of the holy sepulchre. The attributes of Christianity, the alpha and omega, labarum, palm tree, cross, &c., were among the decorative sculptures of the altar. In basilicas dedicated to sainted martyrs their remains were deposited in the altars, which also received a niche in which a relic of the martyr was placed.

Sometimes subterranean chapels were constructed under the altars, and adorned with the richest embellishments. They were approached by steps from the interior of the basilica. At the four corners of the altar stood columns which supported an entablature and ceiling, forming a canopy over the altar. This canopy was termed *ciborium*. *Pl.* 27, *fig.* 19, shows that in the basilica San-Clemente in Rome, and under it the entrance to the subterranean chapel.

The part of the basilica lying in front of the sanctuary was set apart by low partitions of richly carved wood or marble, and sometimes raised several steps above the level of the naves. This was the choir, or high choir, which had benches of wood or marble, and a pulpit. *Fig.* 20 represents the high choir of San Clemente.

In some of the basilicas there is erected a small distinct building dedicated to the ceremony of baptism, and termed baptistery; more frequently, however, these buildings were erected in front of the main entrances of basilicas. They were of various forms (*figs.* 21–24). They contained in the centre a deep basin or pool, usually corresponding in form with the ground plan of the building, and the baptismal rite was performed by immersion, amid invocations of St. John the Baptist. Subterranean conduits supplied and drained the pool. Sometimes it was surrounded with columns, which supported the ceiling, as in that of St. Agnes in Rome (*fig.* 29). Afterwards the baptisteries were united with the basilicas themselves, and then occupied the head of the side aisle, set apart by a railing and a portico, as in the basilica in Cividale, of whose baptistery *fig.* 28 gives a view. The ceremony of total immersion ceased after the baptistery had become part of the church proper. Baptismal fonts were then introduced, of which *figs.* 25–27 give the most usual forms. They were large enough for several persons to be baptized standing at the same time. The smaller baptismal fonts were not introduced until several hundred years later, when immersion had been altogether set aside.

4. Description of some Romanesque Basilicas. The oldest basilica built by Constantine in Rome is St. John Lateran. It had the Roman form and four rows of antique columns in the interior. These beautiful Ionic columns have disappeared under casings of pilasters made in the

eighteenth century by Borronini, who also marred the noble simplicity of the building by introducing a number of inferior ornaments, gables and the like. The valuable Romanesque structure was thus changed into a church in the most corrupt Italian style.

The church of St. Clement, whose portico (*fig.* 17), ciborium (*fig.* 19), and choir (*fig.* 20), we have noticed, is located on the way from the Coliseum to the Lateran. It is remarkable for having still the original arrangements given to it when it was erected in the fourth century. In front of it is a quadrangular court surrounded by colonnades with cross-vaulted ceilings. The court contains sixteen Ionic granite columns and four pillars. The church has three aisles separated by two rows of antique columns connected by arches and by two pillars. The semicircular ends of the side aisles form chapels, one of which is decorated with paintings by Masaccio. The centre terminates with the semicircular sanctuary containing the altar and seats for the bishop and priests. The ground plan of the church is simple. The aisles are different in width, which is not in strict accordance with good taste. Nevertheless the effect of the church is very good in spite of the dissimilarity of the capitals; and the only real disturbance of the symmetry arises from the two unsightly pillars introduced by Fontana in the seventeenth century. The floors are in mosaic of various kinds of marble, and the walls have beautiful fresco paintings.

St. Paul's basilica before Rome, on the way to Ostia, is among the finest and largest churches in the Romanesque style (*fig.* 4, plan; *fig.* 30, perspective view of part of the cloister). It was erected in the years 386–395, and has no court like St. Clement's. It has five aisles formed by four rows of twenty Corinthian columns. Those of the two middle rows are fluted and from 31 feet, 9 inches, to 32 feet, $4\frac{3}{4}$ inches high, by diameters from 3 feet 3 to 3 feet 4 inches; the columns in the outer rows are smooth and 27 feet high. The intercolumniations are of three diameters, and the columns formerly belonged to some ancient monuments, probably the mausoleum of Hadrian. A few of them only are newer. The inequality of the heights is counterbalanced by unequal cubes. The columns of each row are connected by arches on which rests a wall with round-arched windows, those of the centre row being placed higher than those of the sides. The fresco paintings of the square panels under the windows have been destroyed by damp. The transept is nearly at the end of the church, and is divided into two parts by Ionic columns and pillars with small altars in front. The main altar is in the semicircular sanctuary. The interior, which was consumed by fire about twenty years ago, was of admirable effect, and the method of lighting it was excellent. It was based upon the Egyptian plan (*pl.* 6, *fig.* 7) of admitting the light through an aperture over the door. The cloister (*fig.* 30) is almost square, being 121 feet by 101. It has several doors to the court and fine arcades placed on low walls with well profiled cornices. The long sides are divided into five, the short into four sections, by pilasters serving as supports for the cross-vault ceilings of the divisions. Between every two pillars are five pairs of small columns standing behind each other and connected by semicircular arches which are

surmounted by the main cornice. The columns have Corinthian capitals; the two shafts nearest the pillars are smooth, the two next ornamental in various ways, and the centre pair have twisted or braided shafts.

A remarkable basilica was St. Peter's, built in 326 by order of Constantine on the spot now occupied by the new St. Peter's, and destroyed in the sixteenth century (*pl.* 27, *fig.* 5, ground plan; *pl.* 30, *fig.* 1, section through the court with the front elevation; *fig.* 2, lateral section). The ground plan is in the shape of a Latin cross, and the building lay in the rear of a large court surrounded by columns and pillars forming covered colonnades. The church had five naves, each with its own entrance from the colonnade. The rows of columns inclosing the main nave were 33 feet in height, by 3 feet, 4 inches in diameter; those of the side aisles were 27 feet, 4 inches high, and 2 feet, 10 inches thick. The rear wall was interrupted by the semicircular sanctuary with the main altar. One end of the transept served as library, the other as depository for the sacred vessels. The length of the church, excluding the sanctuary, was 287 feet; with it, 321 feet. The centre aisle was 75 feet wide, the side aisles 30 feet, and the outer aisles 26 feet; the transept was 265 feet in length. The interior contained ninety-two columns, probably all from the mausoleum of Hadrian. The two rows of columns in the centre had straight architraves on which stood walls with windows 8 feet, 8 inches high, by 7 feet, 6 inches wide, and arched above in a full semicircle. The heights of the various naves were 88½ feet for the centre, 53 feet for the sides, and 43 feet for the outer aisles. The roof of the centre aisles was covered with gilded Corinthian bronze, those of the side aisles with tiles. The ceiling over the choir was arched and decorated with mosaic and painting. The other ceilings were of inlaid woodwork or wainscoting, and were first repaired in 602. The principal entrance had bronze doors from the temple of Salomo. The gable front of the church was decorated with mosaic in 827. Pope Anacletes II. despoiled the basilica of its treasures in 1130, and it was finally taken down in 1503, under the superintendence of Bramante.

The basilica San Lorenzo, before the gates of Rome, on the Tiburtine way (*pl.* 27, *fig.* 8, plan; *fig.* 9, elevation; *fig.* 10, longitudinal section of the choir; *fig.* 11, lateral section; *figs.* 12, 13, windows), was erected under Constantine, whilst the choir was added by Pope Hadrian, 772–791. This choir was enlarged in 1475, by Rosalini, by order of Pope Sixtus IV. The entire building comprises the fore court, the principal and side aisles, the choir with two side aisles, and the sanctuary with the altar. The main nave has two rows of eleven granite columns of the Ionic order, surrounded by a straight architrave and cornice which supports a second tier of columns, connected by arches which are surmounted by the wall with the windows. The lower columns are smooth, and were very probably taken from the ancient portico of Octavia. They are among the finest in Rome; their reduction is in a straight line from base to capital, both of which are very carefully wrought. The sides of the high choir have each five antique Corinthian columns fluted and of exquisite workmanship. Their capitals are connected by fragments of ancient architraves, friezes, and cornices.

carefully grouped into a new entablature which is surmounted by five thin Corinthian columns with arches and wall like those of the main nave. The ceilings of the basilica are flat and decorated in a rich style; that of the semicircular sanctuary is conically arched. The altar has at its corners four smooth Corinthian porphyry columns with a frieze and cornice supporting a dome. The portico in front of the basilica has light Ionic columns, spirally fluted.

The church of St. Agnes was also built during the reign of Constantine, and is situated before the gates of Rome (*fig.* 14, view; *pl.* 30, *fig.* 24, plan; *pl.* 46, *fig.* 16, plan, including the new chapels). In the principal nave it has two tiers of antique columns, seven in each row, the upper ones forming galleries. The columns have different heights and unequal bases, and are connected by arches. Two of the columns have ropelike flutings, 140 in number, and probably date from the fourth century. The comparison of the old and new plans will show that no alterations have been made in this basilica save the addition of the chapels.

The basilica Santa Maria Maggiore (*pl.* 27, *fig.* 6, plan) was built in 352, probably with materials taken from the temple of Juno Lacinia. It was modernized, though to little advantage, by Cosmo, Pietro di Cortona, and Rainaldi, in the seventeenth and eighteenth centuries. The interior has two rows of eighteen antique Ionic columns connected by an entablature with two large consoles. The altar had four columns around it, two of which have been removed by one of the restorers in order to attain a large opening, which is arched and interrupts the entablature, the arch resting on two coupled columns on either side. Behind these are pilasters, supporting others whose capitals are connected by arches. The wooden panelled ceiling rests on the entablature of the upper Corinthian pilaster. The choir terminates in a pentagon, and is arched above. The front is very deficient in taste, and dates from the sixteenth and seventeenth centuries.

The church of the Holy Cross in Jerusalem (*fig.* 7, plan) was erected in the fourth century as a Christian basilica, restored in 1144, and finally spoiled by Gregori in the seventeenth century, who caused the beautiful Ionic columns to be cased in pilasters. The portico of this basilica has eight columns from which three doors, *a*, *b*, *a*, lead into the court C, which is flanked by colonnades. Three doors lead from this court into a hall, D, behind which lies the baptistery with columns on three sides, and in the centre the font, *e*. The fourth side is occupied by three doors leading into the basilica, F, which has five naves, the principal one ending in a semicircular sanctuary lined with small columns and containing the altar, *g*.

The basilica St. Saba, before St. Paul's gate in Rome, was erected in the fourth century (*pl.* 33, *fig.* 21, plan; *fig.* 22, plan of the choir, showing the stairs to the altar; *fig.* 23, front view; *fig.* 24, rear view; *figs.* 25, 26, details from the mosaics of the principal entrance). The three naves of the church are of equal height, being formed by two tiers of seven columns, the lower ones supporting galleries over the side aisles. Two of the twenty-eight columns are of black, two of red porphyry, the rest of Parian marble; all antique. The portico was added in 770; its decorations and materials are

also antique. The story over the portico, which is very much out of place, is of later date. The sanctuary and the two chapels, containing the library and the sacred vessels, are semicircular and roofed with tiles.

The basilica Bibiana, erected in 365, has been modernized, and thereby despoiled of its characteristics, by Bernini. Its ground plan is given in *pl.* 46, *fig.* 15. It contained sixteen columns, arranged in two rows and two tiers.

The plan of the basilica, which was changed into the church San Cosmo e Damiano (*fig.* 18), is curious for the division of the side aisles into small chapels by pilasters and columns. *Fig.* 17 gives the plan of the Roman Basilica Julia, now San Grisogno, remarkable for a pure Doric portico of four columns.

The basilica erected by bishop Pamfili in Tyre, in the fourth century, resembles that of San Cosmo, in having chambers or chapels in the side aisles (*pl.* 30, *fig.* 25, plan), but is unique in having a court all round. It is contemporary with a Latin basilica near Athens, the ruins of which we have given in front and rear views in *figs.* 10 and 11.

B. Byzantine Style.

The Eastern churches were mostly of a square, round, or polygonal form. Of the latter form a beautiful example is found in St. Vital's church in Ravenna (*pl.* 29, *fig.* 1). The characteristic difference between the Byzantine and the Romanesque styles is that the former always had a cupola, whilst the latter, even the buildings whose form was round, had flat roofs of carpentry. The type of the Byzantine style is given in the plan of St. Sophia's church in Constantinople (*fig.* 18), constructed by Isidorus of Miletus and Anthemius of Tralles, by order of the emperor Justinian. It has many oriental characteristics which were copied in all the later buildings of this school, both in the East and in Italy, Germany, and France. The proof that St. Sophia's church is the prototype of the Byzantine ground plan is found in the various plans of other churches, of which we enumerate the church of Navarino in Greece (*pl.* 30, *fig.* 12), Panhagia Nicodimo in Athens (*pl.* 28, *fig.* 1), and the Catholicon or the Cathedral of Athens (*pl.* 29, *fig.* 9). Others will be adduced hereafter.

Before passing to the description of Byzantine fronts we must mention some peculiarities of this style. In it freestone and bricks are often used together, the latter laid both in horizontal and in vertical lines, so as to form frames round panels of freestone. Great variety of decoration is attained in this manner, enhanced by the application of moulded, curved, and Y-shaped bricks. Another peculiarity of this style is, that the slope of the roof seldom appears to view, the top of the building being generally a straight line, surmounted by a cupola over the central rotunda, and sometimes by smaller domes at the sides, marking the points of connexion between the vestibule and the side aisles in large buildings. A curious Byzantine edifice is the church of Samara in Greece (*pl.* 28, *fig.* 2).

The large Byzantine cupolas rest either on cylindrical substructures or on the roof itself, and have numerous circular openings or windows through which the spherical vaults are lighted. The tiles are generally flat like the

Roman, and joined in the Grecian manner, by semi-cylinders placed on the joint ridges, but the ~-shaped tiles are also met with overlapping each other, and therefore without the peculiar Grecian semi-cylinders. The domes are frequently covered with lead plates. The gallery usually found in the first story of Byzantine churches is indicated exteriorly by a row of windows, or by small arcades. This arrangement was also adopted in the pointed-arch style of architecture when it superseded the Byzantine. The Byzantine semicircular arches over the windows are either entirely of brick, or of brick and freestone in alternate wedges. The doors are usually set in thin stone or marble frames with cornices. Arches constructed over the lintels serve to relieve the latter of the weight of the upper wall. They are sometimes of horse-shoe form instead of semicircular. The mouldings of the lintel cornice are peculiar, consisting of a socle of considerable projection over a projecting quirked moulding (*apothesis*), followed by an astragal with two very narrow socles, and finally a broad stripe. Below this is a rectangular deep recess with an astragal running round the door opening. *Pl.* 30, *fig.* 16, exhibits this bold profile, which was the prototype of the similar one applied in the pointed arch style.

The side fronts of the Byzantine churches are almost exactly like those of the Romanesque. Projecting entrances frequently mark the extremities of the transepts, as in St. Nicodemus' church in Athens (*fig.* 13). The rear wall, which is horizontally closed above, is interrupted by one or three sanctuaries which are either round or quadrangular, and have one or two rows of niches, in newer buildings superseded by windows. The latter are either simple or coupled, when they are called twin windows. The window arches rest on small columns placed at the salient angles of the window recesses, as in the choir of St. Theotokus in Constantinople (*fig.* 14). The vestibule in Byzantine buildings is always arched, sometimes with a dome as indicated in the ground plan (*fig.* 12), and framework is never visible in the ceiling. The vestibule is not very deep, but occupies the full width of the church, and is usually decorated with paintings or mosaic work. One or more doors of similar construction with the main entrance lead into the church proper. The rear wall of the vestibule has sometimes, besides these doors, windows, placed there for the better airing of the church, with window-sills formed of highly sculptured marble slabs. The interior has one or more domes decorated with paintings and mosaic. The principal one is over the point of intersection of the main nave and transept, and is never wanting. If there are more than one, the second and third, of smaller size, are placed over the arms of the transept, the fourth over the sanctuary, and the fifth over the front part of the main nave. The parts of the church that are left without cupolas receive cross-vault ceilings instead. The weight of the cupola is sustained by four corner pillars, being divided between them by ribs of vaults ascending from their cornices to the pendentive or lower circumference of the dome, which they support. This construction was invented by the Byzantians. It is either simple, forming a warped surface of twofold curvature; or hollow, like the upper part of a niche, the curve being that of a cone; or finally, complicated, being composed of a

number of small vaults placed over one another. The latter is the construction usually employed by the Arabians. The corner pillars are connected in pairs by large semicircular arches, whose archivolts support the circle forming the foot of the dome. The pillars and vaults are covered with painting and mosaic, and in important churches they are frequently faced with marble like the walls. In smaller churches the domes are sometimes placed on marble columns instead of pillars; the former are, however, not calculated to sustain the weight of large cupolas.

The altar of the Byzantine churches is a cube or a cylinder of marble, or some other stone, and has no substructure like the Romanesque. Its perpendicular sides are covered with drapery, embroidered with the Grecian cross and the symbol of trinity. The ciborium is like the Romanesque, being a cupola resting on four columns and four arches. In front of the altar is a sacred inclosure, having two door wings with the sign of the cross.

The details in the Byzantine buildings are in a great measure borrowed from the ancient Greek architecture. The basilicas therefore contain numerous columns of marble, Greek or Roman capitals, architraves, and cornices, bearing evidence of the Athenian or Ephesian sculptor. But when available fragments became scarce the Byzantine artists were compelled to produce original works in accordance with the massive forms of their basilicas. They then made their own heavy capital, which resembles the Corinthian divested of its foliated ornaments, and with its cup pressed into quadrangular shape. This nearly cubic mass received only a few ornaments in raised foliation. *Pl.* 30, *fig.* 14, a capital, and *fig* 23, base, from St. Vital in Ravenna; *figs.* 21, 22, base and cap from the Turkish baths in Constantinople, from which is also the capital, *pl.* 28, *fig.* 19; *pl.* 30, *figs.* 19, 20, base and cap from St. Miniato in France; *fig.* 18, *a*, *b*, base and cap from St. Michael's in Pavia, exhibiting fantastic figures in place of foliated work, are examples of Byzantine details, which were much imitated in Italy, on the Rhine, in Normandy, and in England, where they were frequently employed in the 11th century. The decorations on the Corinthian entablature and cornice underwent similar changes, the mouldings being replaced by a few inclined planes, which were embellished with sculptures, painting, or mosaic (*pl.* 28, *fig.* 13, cornice from the Panhagia Nicodimo, in Athens). The sculptures on the Byzantine ornamental work are broad and heavy, exhibiting frequently strings of pearls and festoons apparently set with precious stones. The foliated work is very boldly profiled, the leaves generally terminating in points (*fig.* 14).

The first church executed in this style was the church of the Holy Sepulchre in Jerusalem, which is described in the historical part of this work, and illustrated in Plates, Division IV., *pl.* 39, *figs.* 4–6, where we have also mentioned St. Mary's church on Mount Moriah, and the church of Bethlehem (*figs.* 1, 2). Byzantine architecture was therefore first introduced into Palestine in the middle of the fourth century.

When the old church of St. Sophia in Constantinople was destroyed during a riot, Justinian resolved to replace it by a new edifice intended to exceed all existing churches in size, boldness, and splendor. This work was

finished within the short space of four years. The eastern dome was destroyed twenty years later, in consequence of an earthquake, but was quickly rebuilt, and the church consecrated for the second time by Justinian in the thirty-sixth year of his reign, and has now stood for 1200 years a great monument to its enlightened projector.

This grand edifice (*pl.* 29, *fig.* 18, plan; *pl.* 28, *fig.* 3, view; *fig.* 4, section) covers an area of 2524 square toises, three fourteenths being occupied by walls and pillars. In front of the church is a court with colonnades having sixteen columns in breadth and five in depth. The front of the building is occupied by the principal entrance and twelve niches, and forms the rear boundary of the court, which is 188 feet broad and 90 feet in depth. The portico has five doors leading into the vestibule, from which the interior of the church is approached by nine doors. The central nave is 158 feet wide, and closed above by one entire and two half cupolas of the same diameter. The summit of the central dome is 189 feet from the floor. This dome has twenty semicircular windows, and rests on four pillars, 36 feet high and 18 to 24 feet thick, and on six columns of Egyptian granite standing between the pillars. The entire building is 352 feet long, by 306 feet in breadth. The sanctuary is raised a few steps above the floor, and forms a semicircle of 48 feet in diameter. Between the sanctuary and the principal nave were the seats of the emperor and patriarch, each on its own side. The great pillars are of freestone firmly anchored with iron. The weight of the domes was made as light as possible by employing in their construction pumice and light bricks from Rhodes. The rest of the masonry is of burnt bricks. The interior is faced with marble, jasper, and porphyry, but the costly material exhibits only indifferent workmanship. Many of the capitals are very tasteless in form and decoration. In some places the facings of costly stones are interrupted by panels of mosaic work in which gold foil is extensively used. Many of the columns used in the building were donations, among which are conspicuous eight porphyry columns from Aurelian's Temple of the Sun, sent to Constantinople by a Roman matron, and eight of green porphyry sent by the authorities of Ephesus. The total cost of St. Sophia is computed as having exceeded five millions of dollars. Besides this church Justinian caused twenty-five others to be built in Constantinople, some of them only little inferior in size.

St. Mark's in Venice (*pl.* 30, *fig.* 6, plan; *fig.* 7, view) was commenced in the eleventh century by order of the Doge Orceolo, and the construction was continued by the Doges Contarini and Selvi. It occupies the site of the old church, destroyed by fire in 976. In the year 1071 it was so far completed that the facing with marble and mosaic could be commenced. Its front and the arrangement of the cupolas in the interior show many affinities to St. Sophia's in Constantinople. It is connected with the palace of the Doges by colonnades exhibiting Byzantine, Moorish, and pointed arches. The church differs from St. Sophia's in the following particulars. The latter has one full and two half cupolas besides four smaller half cupolas attached to the walls of the principal nave, and forming the ceilings over its four corners at about two thirds the height of the two half cupolas that

form its ends. St. Mark's has five complete domes, surmounted by pear-shaped turrets on their summits. The front of St. Sophia has simple buttresses, whilst St. Mark's has sixty-six Corinthian columns 13 feet high, on pedestals, grouped perspectively around five entrances of different sizes and surmounted by bold arches. St. Sophia's has no such gateways. The cupolas in St. Mark's are constructed of timber and coated inside and outside. This construction was adopted in order to attain the greatest possible lightness, the edifice being erected on piles. It also allowed the construction of very light walls, those under the cupolas being only 3 feet thick; the walls of the circumference 4 feet; the pillars dividing the gateways, however, are 14 feet thick. The faces between the arches in the front are decorated with mosaic work. The main arch over the centre entrance supports four bronze horses of Greek workmanship, whilst its archivolt exhibits the pictures of the prophets distributed in festoons of leaves. The doors are of bronze, and were cast in Venice in the fourteenth century. Those of the main entrance are said to have been cast by Grecian artists, and were carried away from the church of St. Sophia in Constantinople after the conquest of that city by the Venetians. The perspective gateways form porticoes before the doors, and are decorated like the interior of the domes with mosaic work. The altar stands on four antique columns of yellowish marble in the semicircular sanctuary. It is separated from the nave of the church by a railing supporting the statues of St. Mary and the twelve Apostles, made by the brothers Giacobelli in the fourteenth century. The church contains a number of other remarkable statues. The doors of the vestry, cast in 1576 by Sansovino, and exhibiting several haut-relief figures, are real masterpieces.

The church of St. Theotokus in Constantinople (*pl.* 28, *fig.* 5, view; *fig.* 6, lateral section; *fig.* 7, plan; *figs.* 8–15, details), has greater architectural affinities to that of St. Mark than of St. Sophia. It was probably erected under Justinian. The principal entrance is on the west side, and is approached by a double flier. The portico extends some distance back on both sides of the naves, and is lighted by two windows, each of three arched divisions, formed by two columns between three sculptured marble panels. In this portico are a number of columns, evidently antique. Both extremities of the portico have entrances to the side porticoes. The northern one has two columns and leads into the baptistery. A door on the south side of this room leads into a vestibule situated between the front portico and the naves, and having three doors leading into the three naves, three others opening into the front portico, and one opposite the entrance from the baptistery, which leads into the south portico. The church proper forms an exact square, but its middle nave is much wider than the side ones. The centre is surmounted by a dome resting on four columns. The vestibule and portico have four other cupolas. The sanctuary is separated from the principal nave by two thick pillars, and communicates by doors with the two vestries, which have also doors to the side aisles. On the south side of the church a second side aisle is attached, which has its separate entrance from without and communicates with the church proper by three arches

resting on two columns and the corresponding corner pillars. The distribution of the windows in the principal front is peculiar and clearly illustrated in *fig.* 5. It will also be seen from this figure that the front has no main cornice, but only a curved line over the arches of the windows, whilst it is finished above by the three cupolas over the portico, overtopped in the centre by the dome of the central nave. The construction of the cupolas over the portico is seen from the section (*fig.* 6). The other cupolas are constructed on the same plan.

The Catholicon, the Cathedral of Athens (*pl.* 29, *fig.* 9, plan; *fig.* 10, front view; *fig.* 11, rear view; *figs.* 12–17, details), is one of the few buildings which have escaped destruction in the war of independence. It was probably built in the tenth century, for the gables indicate a peculiar application of framework which was foreign to the earlier Byzantine style, and betray Italian influence. Its form is a rectangle, whose length exceeds its breadth by one half. The first third is occupied by the vestibule. The church proper has three naves having semicircular apsides with narrow windows. The sanctuary alone projects on the rear of the building in form of a semi-hexagon. There are three entrances to the church, on the south, west, and north sides. The entire building is of white marble. The door in the main front, which is approached by two steps, has a straight lintel, but over it a richly moulded arch inclosing a sculptured panel. Several quadrangular panels on both sides of this arch exhibit bas-reliefs, in which lions occur, probably alluding to Venice. The whole is surmounted by a rich frieze and cornice which separate the lower part of the edifice from the gabled roof of the portico, whose front or gable field is richly decorated with sculptures. The rear has two oblique cornices imitating the front gable and surmounting the sloping roof of the sanctuary. The dome over the main nave has eight windows, with eight paintings between them representing eight apostles. Over these are eight angels in medallions, and the centre is occupied by a colossal picture of Christ. The walls of the interior were decorated with paintings, of which in many places traces are still perceptible.

A remarkable church in point of construction is St. Vital's in Ravenna (*pl.* 29, *fig.* 1, plan; *fig.* 2, interior view; *fig.* 3, longitudinal section; *figs.* 4–8, details). It was erected in the year 547, after a plan sent from the east, but whose designer is unknown. It is ascribed to Justinian, on account of the repeated occurrence of the name Julian, who was the treasurer of this emperor. The ground plan of the church proper is a regular octagon, with attached rectangular portico, J, bounded on either end by a circular turret, K K, containing the stairs leading to the upper galleries. This portico has been supplanted by a modern one (*fig.* 1 H), lying obliquely to the axis of the church. In the rear the original arrangement is preserved, the rectangular attachment containing the sanctuary, F, with a semicircular apsis, the vestries on both sides, and also round turrets at the ends, containing entrances from without. The centre of the church is surrounded by eight massive pillars supporting the cupola. Between them, except at E, where the view of the sanctuary is left free, are

triple arches, resting on pairs of columns and supporting the ceilings of the side buildings (*exedræ*), which, on account of the octagonal shape of the church, do not form regular aisles. From two of these exedræ the sanctuary is approached through the arches G G. Over the exedræ are the galleries, which again are bounded by columns resting on the lower ones. In the construction of the cupola (*fig.* 4) great lightness has been attained by the use of earthen vases (*amphoræ*, *fig.* 4 *b*), in rearing the vault. They are placed vertically over, or rather in, each other, the points of the upper ones being placed in the necks of those in the row below. This arrangement is continued to the top of the windows. From thence upwards they are placed horizontally in a continuous spiral line to the top of the dome, which is surmounted by a light framework supporting the sloping roof. The interior of the church is rich in decorative sculpture and painting. The columns are peculiar for having no bases, whilst their capitals (*figs.* 6, 7) are formed by two truncated reversed pyramids placed one above the other and having decorated faces. On several of them occur the cyphers of the Bishop Neo and of the Treasurer Julian.

Pl. 29, *fig.* 19, represents the ground plan of the mosque Achmed, in Constantinople, exhibiting a lavish application of columns and domes both in the interior of the building and on its different outer walls, as well as in the spacious fore-court. When the Byzantine style came more generally into use in the west it experienced some important changes. A greater simplicity was introduced in the ground plan, and the front was made to terminate in a triangular roof, sloping on both sides. This was not a gable proper, as no cornice separated the main wall from its top, forming the regular gable field. The church of Trani, in the kingdom of Naples (*pl.* 28, *fig.* 16), exhibits this arrangement, with the variation of having two subordinate lower roofs in the same style. At the same time it is a fair example of the meagreness with which the fronts were decorated in the 11th century. On the other hand, this was the period of the introduction of towers in the construction of churches. The church of Trani has probably the oldest known tower. It is very simple, and like the towers of that time generally, much less high than those of the subsequent German style. This church may, however, be regarded as the connecting link between the Byzantine and German styles, as it exhibits both round and pointed arches.

Pisa contains three remarkable buildings in the Byzantine style: the cathedral, the leaning tower, and the baptistery. The last was not built before the twelfth century, and therefore belongs to another period of architecture; but being strictly in the Byzantine style, we include it here. It is a circular building of white marble, 115 feet in diameter, and 172 feet high. Three steps surround it, supporting twenty rather tasteless columns in three-fourth outline on pedestals. They have capitals with the Roman combination of volutes and foliation, and below them the necks have still other foliated ornaments. The shafts stand $2\frac{1}{2}$ diameters apart, and are connected by elliptical arches, on which rests a poorly moulded entablature supporting 60 columns, again connected by elliptical arches. High gables are placed on every pair of these arches. The gable fields are decorated

with bas-reliefs, and their peaks with busts and statues. The structure is crowned with a peculiar imbricated dome. The interior of the baptistery contains some fine statues by Nicolas of Pisa, the regenerator of sculpture in that period.

The cathedral of Pisa (*pl.* 30, *fig.* 3, plan; *fig.* 4, western elevation; *fig.* 5, perspective view) was designed by Buschetto. Its erection was commenced in 1063 by Dulichio, and it was built with the booty made by the Pisans in Sicily. Its front has three entrances with horizontal lintels, lying between columns with antique capitals, but with shafts of inferior proportions. It is inclosed between high corner pillars. On these and the six columns abut the springs of six semicircular arches, on which rests a horizontal cornice, supporting two corner pillars and eighteen columns between them, having Roman capitals and square abaci. These are connected by 19 elliptical arches, with a straight cornice over them. On the latter stand in the centre ten columns, connected by elliptical arches with another straight cornice, whilst on either side there are four columns, decreasing in height towards the corners, and surmounted by oblique cornices. On the cornice over the centre stand nine columns, connected by elliptical arches, on which is the fourth straight cornice supporting the gable, which is adorned with columns of various heights. On the peak of the gable is a statue of St. Mary; the acroteria support two angels and the lower corner pillars two apostles or saints.

The sides of the cathedral have very nearly the same arrangement, only that pilasters take the place of columns. Over the second tier of pilasters are an architrave and cornice, whence the slopes of the roofs over the side aisles rise to the higher walls of the centre nave, in which their upper ends are lodged. The highest part of the side walls of the centre nave is decorated with half columns, connected by elliptical arches, and having closed windows, with semicircular tops, between them. The rear of the church has three tiers of pilasters. The intersection of the nave and transept is surmounted by a high, egg-shaped cupola, with a ball at its top. The total number of columns in the structure is 450, of which 208 are in the interior. Many of them have been taken from antique monuments; among others, 24 Corinthian granite columns, which are supposed to have belonged to the baths of Hadrian.

The renowned leaning tower of Pisa stands in the south-east angle formed by the transept and sanctuary of the cathedral. Its construction was commenced in 1074, by the German architect, Wilhelm, of Innsbruck. Its diameter is 50 feet, including the wall. Its total height is 170 feet. It consists of eight stories, exhibiting on the outside 267 small columns, arranged in eight tiers. They have poor capitals, and are connected by elliptical arches, surmounted by rather narrow cornices, surrounding the tower between the different tiers of columns. The entire structure is of white marble. Its inclination is very considerable, the summit being 12½ feet out of plumb-line. It has not yet been satisfactorily decided whether the obliquity of the tower lay in the intention of the architect or arose from the tower having settled on one side. Some strongly favor the former view, holding, as the tradition relates, that the architect, who was deformed,

and therefore had intentionally built this tower oblique. An inscription is said to have been found in the tower, running thus: *Wilhelmus, Œnipontanus, obliquus, obliqui vindex* (Wilhelm, of Innsbruck, the deformed, vindicates deformity). Wiebeking, however, who has carefully surveyed the entire structure, is of opinion that its obliquity is owing to the ground's having given way, and that a counterpoise had been attained by filling part of the interior with a mass of earth.

We will now examine a few buildings of the Byzantine style in Germany, showing the changes it there underwent, and its gradual approximation to the German style.

The cathedral of Bonn (*pl.* 30, *fig.* 9 *a*, plan; *fig.* 9 *b*, perspective view from north-east) is a remarkable building of this class. It is said to have been originally built by order of Helena, mother of Constantine, and dedicated by her to the martyrs Cassius and Florentius, in the year 319. The present structure, which bears traces of the old arrangement in several parts, especially on the south side of the choir, was commenced in the eleventh century, and the central spire was finished in 1177 by Gerhard von Sayn. The ground plan forms a long quadrangle divided into three unequal naves. The eastern extremity is occupied by a long choir, a semicircular sanctuary, and two attached spires. The transept below the choir is short, and terminates in polygons at both ends. The octagon at the point of intersection of nave and transept designates the position of the principal spire, which contains the belfry. The principal entrance, at the western end of the church, is flanked by two small round spires. The interior of this cathedral exhibits uncommon boldness. Its outlines are of unparalleled purity; the arrangement of tiers upon tiers of columns and arches is exceedingly graceful. The spires are perfectly proportioned and governed by the bold centre spire. These combined merits make the cathedral of Bonn an object of universal admiration. The semicircular wall of the sanctuary has under its cornice, which rests on consoles, a beautiful gallery formed by arches. Under it are the large windows through which the choir is lighted. Under the choir is a crypt. The sides of the naves have pointed arches, whilst the spires and the polygonal walls of the transept exhibit the true Byzantine round arches, surmounted by cornices between the tiers of columns.

The effect of the interior is not less striking. The naves have round-arched ceilings resting on thick pillars and on the side walls. The thickness of the pillars is disguised by two tiers of columns placed in front of them. Those of the lower tier are connected by round arches, the upper ones by pointed and divided arches. The imposing effect of the church is owing to the coldness of the stonework rather than to decoration, in which the cathedral is much less rich than the Italian buildings of the same period. Its principal features are perfectly Byzantine, especially the arrangements of columns over one another. The mixed application of round and pointed arches, though attempted with surprising skill, and pleasing in effect, shows a want of unity in the construction which would seriously disturb the excellence of the building, were it not counterbalanced

by the exquisite taste with which the interior decorations have been introduced at a later period.

St. Castor's church, in Coblentz (*pl.* 28, *fig.* 17), was founded in the 10th century, in the Byzantine style. In 1388 the choir was added in the German style. The church proper is divided into three naves. The central one is 30 feet wide from centre to centre of the pillars, and had originally a wooden ceiling. The cross-vault ceiling was not introduced before 1298. The side aisles are only 13 feet wide, and have cross-vault ceilings of porous tufa. The length of the centre nave in the clear is 148 feet; its height, to the keystone, 39 feet. At the sides of the lower end of the choir are two old towers, 95 feet high.

A very interesting building is the hall of the Abbey of Lorsch, in Hesse-Darmstadt (*pl.* 33, *fig.* 11, plan; *fig.* 12, elevation; *fig.* 13, longitudinal section; *fig.* 14, capital of the interior columns; *fig.* 15, capital and base of the exterior columns; *fig.* 16, details from the pilasters in the upper story; *fig.* 17, main cornice; *fig.* 18, middle cornice; *fig.* 19, impost cornice; *fig.* 20, ornament of the inner arch).

This hall formed the entrance to the court of the abbey which was destroyed by fire in 1090. It is now used as a chapel. It is 33 feet long, 24 feet broad, and 25 feet high, and has two stories. The lower story has on both sides (east and west) arcades of three round arches, with two columns between them and two at the ends. These columns have Ionic bases, and capitals resembling very much the ancient Composite order. The acanthus leaves are rather rudely wrought. On the capitals are square slabs. The middle cornice resting on these pillars has foliated decoration and a pearl moulding which strongly remind us of the cornices of the ancients. Its upper socle is a little inclined to produce a boldly marked shade. The front of the upper story has ten fluted pilasters supporting nine isosceles archivolts, forming pediment shaped ornaments. These ornaments never occur in the South of Europe, but are frequent in England, being among the characteristics of the Anglo-Saxon style of architecture. The capitals of the pilasters are formed by two rows of eggs and two volutes. They are a clumsy imitation of the Ionic capital. All the cornices, columns, and pilasters are of hard, white freestone; the walls are inlaid with lozenge-shaped plates of red and white marble. The windows in the second story, which are round-arched, cannot have been made at the same time with the rest of the building, but must have been added when it was arranged for a chapel. At the same time, probably, the eastern arches were closed and the altar placed against the wall, with two columns and an arch as decoration. The round tower at the southern end of the hall is of more recent date, and was evidently only built in order to place in it the staircase leading to the tribune in the interior of the hall.

The Abbey of Lorsch was founded in 764, under Pipin, by the Benedictine abbot, Gundeland, and was consecrated in 774, in presence of Charlemagne, his consort Hildegarda, and his sons Charles and Pipin. The style in which the hall is built corresponds perfectly with this minute in the chronicles of Lorsch. It is therefore greatly surprising that the distin-

guished archæologists, Kugler and Schnaase, give the period of its construction as being in the twelfth century, whilst not a single detail, far less the plan of the hall, corresponds with the style of the latter period.

C. Gothic and Lombardic Styles.

1. Gothic Style. About the middle of the fifth century when the Byzantine style was prevailing in Constantinople and the East, and the Romanesque the most frequent in Rome and the west, a new style was introduced in Northern Italy under King Theodoric, the *Gothic*, which must not be confounded with the *old German* style which is often misnamed Gothic. Theodoric was passionately fond of the arts and lavish in his expenditures for their development. He devoted large sums annually to the preservation of the ancient Roman monuments, especially the aqueducts and the amphitheatre. During his reign a great number of buildings were erected in Naples, Pavia, Spoleto, Verona, and Ravenna. In the last town there are still ruins of the palace of Theodoric which testify to an economy in outward decoration, quite uncommon in that period in other countries. The mausoleum of Theodoric in Ravenna (*pl.* 28, *fig.* 18), built in the sixth century and still existing as the St. Mary's round church; the front of the Franciscan convent, believed to be part of the palace; the baptistery and other buildings of the fifth, sixth, and seventh centuries show the peculiarities of the Gothic style proper. These consist in very strong walls; in columns and pillars of good proportions but with capitals decorated with other foliation than the antique orders; in Roman leading ideas and the exclusive application of the semicircular arch and semi-cylindrical vault.

The mausoleum of Theodoric was built by order of Queen Amalasunta. It is of Istrian marble, and its details may serve as a good illustration of the Gothic style. Its cupola is of a single block of marble, 34 feet in diameter. Twelve projections were left on the exterior of the cupola, to which the ropes were fastened for lifting this monolith. They appear in the elevation like so many small garret windows. The parts of the exterior are well arranged, the doors well profiled and ornamented. The lower part, containing the sepulchre, is filled up with earth.

Only a limited number of buildings in the Gothic style have been preserved. They all prove that this style equally approaches the ancient Roman and the Romanesque. Triangular gables, such as were peculiar in the Byzantine and German styles, never occur in the Gothic, which therefore cannot be confounded with either.

The *Visigothic style* is sufficiently independent to claim a special notice. It occurs chiefly in Spain. The principal church of Tarragona and one of the gates of Barcelona are good examples. The Visigothic style in which the walls are frequently interrupted by round or polygonal towers came into requisition when, in the times of club-law, strength in building was particularly desirable. It therefore was termed the *castle style* by the Franks and Normans, who frequently erected buildings in this style. We have treated more largely of this style in the part of this work relating to Military Sciences when noticing the fortification of the middle ages, and

given as examples the Bastille in Paris (Plates, Division V., *pl.* 46, *figs* 8–10), the tower of Montlhery (Div. V., *pl.* 44, *figs.* 5, 6), and the castle of Vincennes (Div. V., *pl.* 44, *figs.* 14, 15).

2. The Lombardic Style. The buildings erected by the Lombards in Italy, in the 7th and 8th centuries, principally churches, are in their main features Byzantine; but for several peculiarities they have been grouped by themselves, and constitute the monuments of the Lombardic style. Their characteristics are the following: 1. Very small semicircularly arched windows. 2. Small arched niches, separated by thin pillars under the slopes of the gable, as in St. John's church in Pavia (*pl.* 28, *fig.* 15), which is the best example of the Lombardic style. 4. Half or three fourths columns at the entrances, grouped so as to form perspective gateways. The columns of the two sides are connected above by semicircular arches. Their bases, shafts, and capitals are decorated with rude foliated work or symbolic figures, whilst the Byzantine capital in a measure approaches the Corinthian. The columns in the interior have generally rude cubic capitals supporting the arches. 5. The frequent spiral arrangement of the foliated decoration on the shafts. 6. The rude sculptures, frequently satirical representations of the abuses of priestcraft. These are found mostly in the entrances. 7. Festoons, wrought in stone, under the main cornices and under those marking the different stories of the churches or towers. 8. The invariably pyramidal spires on the towers.

The Lombardic style has been frequently adopted in the churches of Germany. In attempting to classify the buildings of the middle ages, however, and to group them in the various styles, the duration of the construction must be taken into account and allowance made for additions to the original plans, since the later architects did not generally aim at uniformity by following the style of the original designer, but frequently adopted the taste of their own period. Thus the cathedral of Bonn (*pl.* 31, *fig.* 9 *b*), which we have considered among the Byzantine buildings modified in their introduction into Germany, has been adorned with the festoons and the pyramidal spires peculiar to the Lombardic styles, in contradistinction from the Byzantine.

D. The Arabian or Moorish Style.

When the Arabians, after conquering Africa, 665–689, penetrated into Spain in 710, they introduced in the interior of their edifices a richness in mosaic work, slender columns, inlaid floors, and magnificent ceilings, which far surpassed that of all other decorations of that age. Their rich architecture chiefly flourished in the 7th and 8th centuries in Bagdad, Cairo, Alexandria, Fez, Cordova, and Barcelona. It reached its climax in the palace of Alhambra, near Granada, of which we shall presently speak. Originally the Arabian edifices must have been wholly destitute of splendor, as is seen from the Kaaba at Mecca, built 100 B. C., which is quite plain.

The Arabian or Moorish style, as it is usually termed, is entirely peculiar, differing from all other known styles. Among its prominent features are: 1. The horseshoe-shaped arches, which generally occur exclusively, but

sometimes in connexion with semicircular arches, and in a few buildings even surmounted by such. The latter arrangement is of exquisite effect, being exceedingly picturesque, and it is remarkable that it has never been imitated in other styles of building. 2. The Moorish columns, employed in great numbers, are remarkably slender. Their capitals are sometimes antique, but generally of a peculiar shape, best described as two truncated pyramids placed on each other, the upper one inverted, somewhat like an hour-glass. 3. The walls and niches are richly inlaid with peculiar ornaments and sentences from the Koran, sometimes in stucco and frequently even in precious stones. The ornaments are painted with gaudy colors, chiefly purple, azure, and gold. 4. The floors are of colored marble plates, laid in elaborate patterns. 5. The vaults and arches exhibit frequently lattice-work, through which the buildings are lighted. 6. The entablature, consisting of but few members, is always boldly projecting. 7. The height in the clear of the Moorish buildings is generally limited; on the other hand they cover extensive areas. The mosque at Cordova, for instance, which is only 35 feet high in the clear, is 620 feet long. 8. The cupolas, which frequently occur in the Moorish buildings, are mostly bulbiform.

Among the numerous edifices of the Moorish style, we mention the following as the most interesting:

The mosque at Cordova, commenced during the caliphate of Abdorrhaman, in 787, and finished under his son, is remarkable for the number of columns it contains. *Pl.* 33, *fig.* 1, gives its ground plan; *pl.* 31, *figs.* 1, 2, interior views; *pl.* 32, *fig.* 15, a longitudinal section; *figs.* 16 *a b*, and *pl.* 33, *figs.* 2, 3, details of the columns, the two first reminding vividly of the antique; *fig.* 4, a fragment of the principal cornice in the interior; *pl.* 32, *figs.* 17–25, ornaments. In the ground plan, the lighter shaded parts are the additions made by the successors of Abdorrhaman. AA is the original mosque, A the addition made by Almansor, B the forecourt. The wall in the rear of the chapel, *e*, and the hall Maksourah, *a*, which is interrupted by the entrance to the sanctuary, is termed *Mihrab*. Such a wall is found in all mosques. It is always placed at that side of the mosque which lies in the direction of Mecca, so that the devout look in that direction during their prayers. This wall is always the richest in decoration. The apartments *d* and *c* are other chapels. The section (*pl.* 32, *fig.* 15) is in the line *e c* A of the ground plan. The interior view (*pl.* 31, *fig.* 1) is taken from the east side, the hall Maksourah appearing in the foreground to the right; *fig.* 2 gives the interior view of this hall.

The mosque forms a quadrangle 620 feet by 440. The forecourt occupies 210 feet of the length. The building proper is therefore 410 feet deep by 440 feet in width. It had originally 21 doors, of which only five are left. They were coated with richly ornamented bronze plates. The 18 pillars of the front towards the court are surmounted by Moorish arches. The breadth of the building is divided into 19 aisles, 14 feet wide in the clear, partly extending through the entire depth, in part only a limited distance. According to Murphy, the edifice contains 850 columns of granite, porphyry, jasper, and various kinds of marble, among which are many that

were carried away from Roman and Carthaginian buildings. The columns are only 18 inches thick, and not much above 12 feet high. The arches sprung from front to rear are Moorish; those from side to side, resting on the capitals of the columns, are of the same form, but their springings are laid against pillars which rise between them from the capitals of the columns, and are six to eight feet high, terminating in cubic capitals, on which rest somewhat depressed Romanesque arches which connect them. The spaces between the upper and lower arches are left open. The effect produced by this extensive lattice-work between the arches and the ceiling is very pleasant. The arches of the hall Maksourah (*pl.* 31, *fig.* 2) are still more complicated and their effect grander in proportion. Their construction is more easily illustrated than described; a glance at our figure will give a clear idea of their surpassing splendor.

When the Moors lost the supremacy in Spain, the mosque was made a Christian church, but remained unaltered until 1528, when several alterations were made in the interior, executed in the German style, and totally destroying the harmony of the whole. The chapels, especially, which we have mentioned are in grievous discordance with the leading features of the ground plan.

The greatest architectural work of the Moors is the palace Alhambra, built by order of Mahomed Abu-Abdallah, in the beginning of the 13th century, near the city of Granada. This edifice is situated on a hill by itself; its various component parts covering an area of 2300 feet by 600. The exterior is rather plain. The buildings are approached by a Grecian gate, erected by the Emperor Charles V. The inner gate is known as the Gate of Justice, having formerly been the place where minor litigations were adjusted. Above this gate a colossal hand is wrought symbolical of judicature. Some have thought it and the key over another gate to have been intended for a magic spell which was to insure perpetuity to the palace. These gates lead into an open space with a tasteful palace erected by Charles V. Thence a simple gate leads into the palace of the Moorish princes, Alhambra proper. The first court, that of Alcerba, is paved with white marble. In its centre is a reservoir, 130 feet by 30, surrounded by rose trees and containing gold fishes. Thence an arcade leads into the court of the lions (*pl.* 32, *fig.* 1), named from twelve lions which support the alabaster reservoir of a magnificent fountain in the centre of the court. The splendid halls surrounding this court afford the best facilities for studying the details of the Moorish style, of which we have represented a number in *figs.* 2–12. Only the sides towards the court have white marble arches; the ceilings are of wood, flat, and gorgeously decorated. One of the halls exhibits rich inlaid stucco from Damascus, and designs ornamented with inlaid work of lapis lazuli. Among the many divisions of the palace, the hall of the ambassadors, or the golden hall (*fig.* 13), and the hall of the two sisters (*fig.* 14), are the most attractive. The latter takes its name from two marble columns found there, which are exactly alike, even to the most minute parts of the decoration. All the apartments of the palace and all its courts and gardens are provided with good water by special water-works.

On another hill opposite Alhambra is El Generalife, a villa of the Moorish Kings, with beautiful gardens. Its entrance (*pl.* 31, *fig.* 4) exhibits the peculiar arches used in this villa. They have the height of the horse-shoe arches, but are closed above with the true arc of the Romanesque style, only with the addition of the Moorish ornaments. The capitals of the columns are of the true Moorish form, resembling hour-glasses in shape. The villa is surrounded by pleasure groves, with numerous fountains.

In Alcaçar, the citadel of Seville, there are several Moorish remains, of which we mention the chapel Zancaron, an interior view of which is given in *fig.* 3. This building evidently belongs to a much later period than Alhambra, as it has German pointed arches besides the Moorish horse-shoe, and numerous ornamental details borrowed from the German style.

In Constantinople the forecourt of the mosque of Osman is a remarkable Moorish structure. The mosque itself is a more recent building, dating only from the last century, whilst the court (*pl.* 30, *fig.* 8) which forms the avenue to it is probably 800 years old. It is in the purest Moorish style, although the columns, which are somewhat thicker than usual in Moorish buildings, have clearly been taken from ancient Roman buildings, their clumsy capitals notwithstanding. The construction of the cupolas over the single vaults is very curious, the ribs of the vaults only being executed rising from the side arches and forming the transition from the quadrangular to the circular form, their upper extremities carrying a circular cornice and a low drum with windows, surmounted by the low cupola, which has the form of a small spherical segment.

In Egypt there are several interesting Moorish edifices, from which we select as examples the two mosques of Ebn Touloun and of El Moyed, both in Cairo. The former was built in the 9th century, by Ahmed Abn Touloun, governor of Egypt. It is peculiar for having no other columns than two at the *Kiblah* (direction of the eyes : therefore sanctuary). Ahmed's first plan had been to excel all older mosques in splendor. He accordingly ordered more than 300 columns to be placed in the forecourt alone. On learning that all Egypt could not furnish this number of columns except by despoiling all the ancient monuments and the Christian churches of theirs, he changed his design, and ordered his architect to build the mosque entirely without columns. This mosque is known by the name Djama ben Touloun. In illustration of the same we have given in *pl.* 33, *fig.* 5, the ground plan; *fig.* 6, perspective view of the court; *pl.* 32, *fig.* 26, longitudinal section along the line *c d* of the plan (B being the upper part of the minaret or steeple A); *figs.* 27, 28, windows; *fig.* 29, one of the niches between the windows; *figs.* 30 *a b*, 31, friezes from the interior; *figs.* 32, 33, the capitals of the columns of the *Kiblah* in the wall *Mihrab*. The ground plan forms a square of 280 feet; on three sides there are two rows of quadrangular pillars; on the south side A, five rows. The entire building, in which Moorish and pointed arches occur in tasteful connexion, is of brick, coated with stucco, and partly painted, partly inlaid. The wall *Mihrab* especially is richly inlaid with ivory, and has numerous inlaid inscriptions in the Kufic character.

The mosque of El Moyed was built in 1415, by the Sultan Abou el Nasse Sheikh Mahmoudy, with the cognomen Melek el Moyed, after his release from captivity with the Emir Mentach. *Pl.* 33, *fig.* 7, represents its ground plan; *pl.* 31, *fig.* 5, the interior view of the court. The mosque forms a square of about 300 feet. Its court is entirely surrounded by colonnades, the east and west sides forming two naves each, the north side three, and the south side four. On this side the *mihrab* is at *b*; *c* is the *mimbar*, or pulpit; the tribune of the *Khatib* or leader of prayers, with the desks *e e* for reading the Koran. At the east end of these naves, in *g*, is the sepulchre of Sultan el Moyed; and at the west end, in *f*, that of his family. At *h* are the magnificent doors leading to the adjoining Bazar of Soukaryeh, *i* the passages to the adjoining school and the stairs to the top of the edifice. Before the northern side of the court is a kind of portico, *k*; at its western extremity the sinks *l*, and connected with it by a passage the public baths, *m*. In the centre of the court, at *n*, is the fountain, surmounted by a tent, unlike the fountain of the Djama ebn Touloun, which has a cupola. The total effect of the edifice is very grand; it is one of the finest monuments of Moorish architecture in the 15th century. The archivolts are composed of red and white stones alternating. The columns, which are all antique, are of different heights, the differences being counterbalanced by unequal pedestals. The ceilings are of wood, panelled and covered with ornaments, which are all painted in bright colors. As usual, the *mihrab* is the most luxuriously decorated. Its splendor is really astonishing.

E. Modern Persian and Indian Styles.

The modern Persian and Indian styles of architecture are peculiar in various points. The roofs of the dwelling-houses consist of very flat-arched terraces, coated with a durable cement. All mosques and sepulchres, on the contrary, have very high artificially vaulted domes. The form of the arches employed in these styles for doors and windows and in ornaments, is very curious. It resembles the bottom of a ship turned with the keel upwards. It is the same form that occurred under the name *ass's-back arch* in German architecture, towards its decline, and occurs in a number of buildings in France and England.

Among the edifices in the Indian style is the *Antler Tower*, in Ispahan (*pl.* 33, *fig.* 10), whose surface is covered with skulls of deer. The colonnade exhibits the curious Persian arches which we have just mentioned.

The Mausoleum of Ibrahim Adil Shah, at Bedjapur (*fig.* 8), shows the bulbiform cupolas which were placed both on buildings of great diameters and on minarets. The Persians were so far advanced in the construction of domes that they arched their smaller cupolas entirely without scaffolding.

Near Delhi is a peculiar tower, Kutub Minar (*fig.* 9), attached to a mausoleum. It is nearly 200 feet high and entirely of red granite. Exteriorly it is covered with ornaments, and divided into five stories by far-projecting cornices. The interior is occupied by a spiral staircase, leading to its summit.

2. The Period from the 11th to the 16th Century, or to the Decline of Art.

Although the Byzantine and kindred styles of architecture, as we have seen, originated in the first portion of the middle ages, yet a number of buildings in these styles were erected during the second. The characteristic style of this period, however, is the *pointed-arch style.* We will devote a few cursory remarks to its peculiarities before entering upon a more minute examination of its principal monuments. For greater clearness we shall separate the various component parts of the churches, and consider each by itself, noticing first that the ground plan was gradually perfected and received a more symmetrical and constant form.

1. The Apsis or Sanctuary. The churches of the 11th and 12th centuries terminate in a semicircular *apsis*, like the basilicas (*pl.* 34, *fig.* 1), connected by a semi-conic dome with the main building. It is, however, generally lower than the latter, whilst its floor is elevated by several steps. In the middle or at the lower end of the apsis stood the altar. Behind it, near the rear wall, was the bishop's throne, which was occupied by this functionary and his two deacons. Sometimes the apsis was triangular, as in the church of Vaison (*fig.* 2); quadrangular, as in the church of Amans (*fig.* 4); or polygonal, as in the cathedral of Carpentras (*fig.* 3); yet its interior was almost always round. At first this part of the church had no windows. They were afterwards introduced, but generally in uneven numbers. In many very old churches the altar was placed against the rear wall, when the bishop's throne was south of it.

2. The High Choir. This occupied the space between the apsis and the transept. It was originally intended for the accommodation of the singers and inferior clergy. Its roof was usually lower than that of the nave, but higher than that of the apsis. The choir was usually separated from the main nave by a railing and the desk at which the Gospel was read.

3. The Main Nave is the principal part of the church, forming, in an architectural point of view, the nucleus around which all the other parts are grouped, and against which they lean. It is therefore the most lofty. It is the place where the worshippers attend service.

4. The Side Aisles are parallel to the main nave, and are only separated from it by rows of pillars or columns. In the basilicas they were cut short by a wall at the base of the apsis; in the Byzantine churches they had subordinate apsides of their own, used as vestry, library, &c.; but in the pointed-arch style they extend far back, encircling the choir and apsis of the main nave, and forming the gallery of the choir, which in many cases has attached chapels at every arch, as in the cathedral of Magdeburg (*pl.* 41, *fig.* 1) and the church *St. Germain de Près* in Paris (*pl.* 35, *fig.* 1). Examples are, however, found of pointed-arch churches and chapels without any side aisles; *e.g.* St. John's church in Beauvais (*pl.* 34, *fig.* 5). On the other hand, the side aisles of very large churches are divided by pillars or

columns into two parts, so that the entire building apparently has five aisles, as Notre Dame in Paris (*pl.* 40, *fig.* 1).

5. THE TRANSEPT is a transverse nave intersecting the main nave and side aisles at right angles at the foot of the choir, and extending more or less beyond the outer walls of the side aisles, as in the basilicas, thus giving the church the form of a cross. The two projections were termed the cross-arms. At their extremities subordinate altars were placed. Small churches and chapels were often without a transept; very large ones had sometimes two, which gave them the form of the *archiepiscopal cross*, or the *cross of Lorrain* (*pl.* 34, *fig.* 6). When the arms of the transept are as long as the main nave, the church forms the *Greek cross* (*fig.* 7); most commonly the main nave is much longer. The church then forms the *Latin cross* (*fig.* 8). In some churches the high choir with the apsis is longer than the main nave. The form of such churches is termed an *inverted cross.*

6. THE PORTALS. The oldest churches had only one entrance leading into the forecourt. Since the courts were abandoned the principal front portal has taken their place (*pl.* 35, *fig.* 3, the portal of Notre Dame la Grande, in Poitiers). The portal is usually on the west side opposite the sanctuary. Sometimes, however, the church has two apsides at opposite ends of the main nave. In such cases the portal is in one of the cross arms, whilst there are subordinate entrances on both sides of the lower apsis, as in the cathedral of Treves (*pl.* 34, *fig.* 14), which is either occupied by a subordinate altar or serves as a baptistery. The grand portal is, in all edifices of the middle ages, the part which received the greatest display of magnificence; yet the subordinate ones added greatly to the splendor of the other façades.

7. THE FOREHALL AND VESTIBULE. Originally the vestibules were forehalls properly so-called. They were attached to the churches, and served to protect penitents against the inclemency of the weather without their entering the church itself. Gradually this use was set aside and the size of the forehalls much reduced until they were entirely done away with, or rather supplanted by the vestibules. Of these there are two kinds, the exterior and the interior. The former are usually constructed in imitation of the antique portico, as in the basilica of St. Vincent in Rome (*fig.* 13). The interior vestibules are sometimes in form of a rotunda with a cupola, as in the Temple in Paris (*fig.* 9). This is an imitation of the church of the Holy Sepulchre in Jerusalem, which is found also in several Romanesque churches. Vestibules are also naturally afforded by the areas of the substructures of the towers or spires, examples of which are found in St. Radegund's church in Poitiers (*pl.* 34, *fig.* 10), in the minster of Freiburg (*pl.* 35, *fig.* 16 *A*), and others. When there are two towers or spires, the space between them is roofed in and forms the vestibule, as in the church of Monreal in Sicily (*pl.* 34, *fig.* 11), the cathedral of Magdeburg (*pl.* 41, *fig.* 16), &c. A vestibule may also be obtained by placing the door some distance back behind the mass of the portal, as in the cathedral of Rheims (*pl.* 34, *fig.* 12).

Another kind of vestibule occurred in the middle ages, attached to the

churches, though answering secular purposes. Such were the halls of the judges or magistrates, where decrees of the courts and ordinances were made public. These were decorated with some peculiar ornaments, often lions, as in St. Zeno's church in Venice (*pl.* 35, *fig.* 4). Hence arose the formula in documents of that age "*datum inter leones*" (given between the lions). Sometimes the magisterial hall, instead of being at the side of the portal, formed part of the same, and then was a vestibule in the proper sense of the term.

There were also in some churches fortified fore-halls, with battlements and loopholes, or with projections over the gates, in the manner of the machicolis which we have described in another part of this work (see Military Sciences, p. 145, or Vol. III. p. 621). Such halls, which were designed for an occasional defence of the churches, are represented in *pl.* 34, *figs.* 15–17, and *pl.* 35, *fig.* 5.

Ornamental fore-halls mostly projected considerably from the façades (*fig.* 6), or the front walls were exceedingly thick, so as to afford space for such halls in the solid masonry. Halls of the latter kind are found in some of the buildings which we shall presently describe, and will then be referred to more in detail. In some cases the fore-halls were merely light attachments, affording shelter against the weather (*pl.* 34, *fig.* 18), or even mere penthouses.

8. The Towers and Spires. Church towers were from the first designed to afford lofty places for the bells, by whose sound, from the very introduction of Christianity, the devout were summoned to worship. They were first added to the Roman basilicas when they were made Christian churches. At first they stood detached from the churches; and in Italy and Germany there are still several such detached towers (*Campaniles*). Subsequently the towers were made to serve still another purpose, namely, of indicating from a distance to the wanderer the site of the church. Hence their increased height, which also served to afford greater scope for the decoration of the edifices. In the churches of the 12th and 13th centuries, the bell tower or spire is mostly placed over the middle of the church, where the transept and nave intersect each other, as in Notre Dame in Dijon (*pl.* 34, *fig.* 20) and the cathedral of Bonn (*pl.* 30, *fig.* 9 *b*). Very large cathedrals have often seven or eight spires; but generally only three, when the two principal ones are placed at the sides of the main portal, and usually a smaller one over the middle of the church.

9. The Vestry is always situated near the high choir. It is less a subordinate part of the church than an addition to it. In many of the older churches it has not been considered at all in the original plan, and has afterwards been added, either by cutting off part of a side aisle, or by erecting a special apsis for it at the angle of the main apsis and a side aisle.

10. The Exterior. The outer walls of churches and other buildings of the different centuries of this period were subject to a great many and important changes. We find on the one hand plain, hard-smoothed walls, and again, those that were decorated in the highest degree of splendor,

even to overloading. The ornament, therefore, is no essential part of the pointed-arch style, but assumes its characteristics in accordance with its rules. The walls that are not held perfectly plain in their larger masses exhibit embellishments of various kinds. They are then usually divided into panels by mouldings or straight members, and these panels ornamented with braided work (*pl.* 34, *fig.* 21), scales (*fig.* 22), or checkered work (*fig.* 23). The walls are, however, also found interrupted by pilasters, or by flat recesses or niches arched above, or with true or imitation lattice-work. Such arches were often subdivided into smaller ones, whose form corresponds with that of the larger arch, and which jointly rest on a column, as in the Byzantine window (*fig.* 24). The filling over the column is then usually pierced, the openings corresponding in shape with the style of the arches, and being three or four lobed (*fig.* 25). Similar apertures are also employed for ventilating in other places; or, when decoration only is aimed at, superseded by mere recesses of the same shape. The arches often appear intertwined, their springings resting on alternate columns or pilasters (*figs.* 26–28, round and pointed arches, with imitation lattice-work).

Special attention is claimed by the columns, pillars, and mitres (or joints) of arches, or arched recesses or niches. Columns are distinguished from pillars and pilasters by their having capitals, and usually also bases. A medium between the two kinds of supports is represented by the *columnar pillars* (*fig.* 29), which are always short and clumsy, and instead of capitals have only an astragal and slab at the top, and frequently only one or the other. A column is said to be incomplete if it has not a distinct base, shaft, and capital, that is to say if one or two of these parts are absent. Thus the base and part of the shaft may be wanting. When the latter is the case, as in half-columns, the lower end of the shaft rests on a console (*fig.* 30), or on a foliated knob (*fig.* 32); or the shaft is truncated, *i. e.* cut off horizontally or obliquely (*fig.* 31). The last mode of construction was frequently not the intention of the first designer, but the absent part was subsequently removed by truncation, in order to gain space or light.

The various forms of the outline of columns are illustrated on *pl.* 34, namely: round (*fig.* 34 *a*); with an obtuse projection (*fig.* 34 *b*); with an acute projection (*fig.* 33 *c*); elliptical (*fig.* 33 *d*); square (*fig.* 34 *e*), the outline of a pillar; rectangular against a wall, the form of a pilaster (*fig.* 34 *f*); and polygonal (*fig.* 33 *g*).

The bases either rest immediately on the ground or floor, or are elevated by plinths or pedestals. They are either composed of mouldings or decorated with animal figures (*pl.* 35, *fig.* 7), with single heads of animals (*fig.* 8), or with foliation.

The various forms of shafts are shown in *fig.* 10 as club-shaped (*a*), swelled (*b*), baluster-shaped (*c*), cylindrical (*d*), and conic (*e*); their grouping is illustrated in *fig.* 11, viz. simple (*a*), crossed (*b*), braided (*c*), broken (*d*), knotted (*e*), and divided by rings (*f*). The different decorations of shafts are represented in *fig.* 12, viz. fluted (*a*), deep fluted *b*), spirally fluted (*c*), lozenged (*d*), facetted (*e*), crimped (*f*), with chevrons (*g*), with steps (*h*), with scales (*i*), and with beads (*k*). Sometimes shafts are also

decorated with vines or climbing figures. They are even at times supplanted by human or fabulous figures (*pl.* 36, *fig.* 1). The columns of the architecture of the middle ages are, however, not subject to strict rules like those of ancient times, and those constructed according to the columnar orders. The columns of the first centuries of the middle ages are indeed clumsy, but as architecture gradually rose from its dejection, they were very much improved, and in the prime of the German style they were of admirable slenderness, their real thickness being skilfully disguised by mouldings and ogees.

The capitals in the middle ages, and especially in the German or pointed-arch style, are of the most varied forms. In their decorations the freest scope is left to the taste or fancy of the architect or sculptor. We have selected a number of examples showing the different forms occurring in remarkable edifices (*pl.* 37). They may be conveniently designated as follows: cylindrical, continuation of the shaft with ornaments (*figs.* 1, 2); cubic, with rounded lower corners (*figs.* 3, 4); strictly cubic (*fig.* 5); conical (*fig.* 6); heart-shaped (*fig.* 7); inverted truncated pyramid (*fig.* 8); cup-shaped (*fig.* 9); knob-shaped (*fig.* 10); prismatic bell-shaped (*fig.* 11); funnel-shaped (*figs.* 12, 13); cubic, with an astragal below (*fig.* 14); and boat-shaped (*fig.* 15). The decorations consisted either of sculpture or of painting, or of both combined. Smooth capitals were mostly painted; there are even instances on record when very excellent sculpture in capitals was filled up with mortar and smoothed over in order to gain a surface for painted ornaments. Not unfrequently most exquisite sculptured work has been discovered on capitals that were thus plastered up. The sculptures of this period represent either the human figure or subjects from the animal and vegetable kingdoms, or the various human pursuits. The human figure appears at first only as a mask on the abacus (*pl.* 35, *fig.* 13); afterwards in half length in foliation (*pl.* 37, *fig.* 16). Entire historical representations are also sometimes met with on capitals (*pl.* 37, *fig.* 17); or clerical processions (*fig.* 16); or symbolic groups, whose import it is frequently difficult to determine (*pl.* 35, *fig.* 14). Again, the ornaments may be mere freaks of fancy. Among them are groups representing human vices, or abuse of clerical power, and their imagined punishments.

Among the decorations from the animal kingdom, few are taken from among the animals of the country; they are generally representations of foreign or even fabulous animals which are supporting the abacus (*pl.* 37, *fig.* 19).

Decorations from the vegetable kingdom are the most frequent, including leaves, flowers, and fruits. These belong usually to the vegetation of the country, rarely to foreign countries; where they are not of the indigenous vegetation they are mostly fantastic. The most common decorations of this kind represent the foliation of water plants (*fig.* 20), which also occur combined with acanthus stems (*fig.* 22) or with other leaves, and set with pearls (*fig.* 21). Indigenous plants were first generally adopted in the 13th century. Among those most frequently met with are the ivy (*pl.* 38, *fig.* 2); the wild vine (*fig.* 3); the grape vine (*fig.* 4); the cinque-foil and

the oak (*fig.* 5); and even the cabbage (*fig.* 6). One of the prettiest fantastic foliated capitals is composed of long, many-lobed leaves, overlapping at the top, and forming small volutes. Among the flowers met with on capitals the principal ones are the rose (*figs.* 7, 8) and a fantastic flower (*fig.* 9). Small capitals of the 13th century have usually projecting foliated volutes at the corners, to which in the 14th century a row of leaves was added (*fig.* 14). In the 15th century the foliated decorations were meagre and stiff, but in the 16th century they again approached the forms of classic antiquity. The capitals of the 11th century appear nearly all smooth, with here and there a few rudely hewn pedicles. In the 12th century they are of a more elegant style and of a nobler form. In the 13th century, the decline of art is perceptible also in the capitals, which are overloaded with leaves and knobs (*fig.* 10). In the 14th century the capitals have two rows of deeply lobed leaves, and the abacus is round or polygonal instead of quadrangular. In the 16th century, finally, the capitals are entirely without gracefulness or richness. The Corinthian abacus (*fig.* 11) was changed considerably, and finally made so thick, that it appeared to crush the capital instead of decorating it.

Apertures or interruptions in the walls, whether they be windows, doors, or only niches or recesses, are closed above in various ways; either by two straight oblique lines, the sides of a triangle, meeting over the centre of the aperture (*fig.* 12), or by gradually narrowing courses of stone, a straight line forming the top (*fig.* 14), or by a curved line or arch. An arch need not be complete; the one-sided or *ascending arch* is on the contrary very frequent in the German style, employed to connect a lower outer wall with a higher uninterrupted inner wall (*fig.* 13), and serving instead of a buttress to the latter. Complete arches appear in the middle ages in a great variety of forms. If the arch be a true arc, *i. e.* described from a single centre, it can have four different shapes: 1. Less than a semicircle, or the *flat arch* (*fig.* 15). 2. A full semicircle, or the *Romanesque arch* (*fig.* 16). 3. More than a semicircle, or the *Moorish arch* (*fig.* 17). 4. A semicircle whose centre lies above the level of the imposts, or the *overtopped arch* (*pl.* 36, *fig.* 2). The centre may be often considerably above that level when, for instance, the arches of intercolumniations or apertures of different width are to have their keystones in a horizontal line without giving up the strictly semicircular arch. The overtopping will then be in proportion to the decrease in width. A variety of the semicircular arch is the *trefoil arch*, which is formed by three semicircles intersecting each other and producing two points (*pl.* 38, *fig.* 18). This construction is very frequent in Germany and England. The three first named varieties of the semicircular arch appear together in the 11th century, the fourth exclusively in the 12th, whilst the trefoil arch is represented at all times from the 11th to the 16th century.

The simple pointed arch, the characteristic one of the present period, is of seven different forms, five of which belong to the 12th century, two exclusively to the 15th. The first and oldest form is composed of two arcs whose centres are but slightly removed to both sides from the centre of the

intercolumniation (*pl.* 38, *fig.* 19). Immediately afterwards appeared the second form, which is very high and pointed, the centres of the component arcs lying far beyond the sides of the arch (*pl.* 36, *fig.* 3). The next form is that of the most beautiful and regular pointed arches. It is called the *equilateral arch*, the centres of the arcs being in the springings of the arch (*fig.* 4). The fourth form is the *lancehead arch*, which is constructed from the same centres, but the arcs are extended below through the level of the centres (*fig.* 5). The fifth form is the *overtopped arch*, whose curves are also described from the same centres as in the two last, whilst the extensions below their levels are in straight lines (*fig.* 6). This arch is employed in the same cases as the overtopped semicircular arch. The two forms belonging to the 15th century are: 1. The *prolonged* pointed arch (*fig.* 7 [b]). The curves forming the sides of this arch are composed of two arcs, the lower one described from the opposite springing as centre; the upper one from a centre a little distant from the centre of the intercolumniation. 2. The *counter arch*, whose arcs are below the level of their centres, each of which is on the same side of the arch as the arc to which it belongs (*fig.* 8). This arch occurs frequently in English architecture. The trefoil arch occurs also in the pointed style in the 11th and 12th centuries; afterwards much corrupted; and in the 15th century in England and France in the flowing or flamboyant style.

The *ass's-back arch*, which is called *Tudor arch* when it is very flat, has sides composed of two arcs, but differs from the prolonged pointed arch in this, that the centre of the upper arc is above the arch as in the counter arch, whilst that of the lower is below the arch, and the entire side consequently a wave line (*fig.* 9).

The *basket arch* (*fig.* 7 *b*), which is a frequent form of our day, appears very flat in the middle ages, especially in France and England; more rarely in Germany, and then only in private dwellings. An example of this latter form is given in *fig.* 10. It is not to be confounded with the horizontal top with rounded corners (*fig.* 11), which is no arch proper, the corners only describing arcs of a very short radius. In the time of the *renaissance* (revival of architecture) pointed arches gradually disappear, superseded by flat, elliptical, and semicircular arches.

The decoration of the archivolts consists either in the introduction of stone of different colors (*fig.* 12), which was the prevalent manner of the Moorish and Byzantine styles; or they are moulded (*fig.* 13); or the stone wedges project more or less (*fig.* 14). An English mode of constructing the archivolt is curious, having a zigzag or toothed ornament (*fig.* 15). There are also lobed archivolts (*fig.* 16) or counter lobed (*fig.* 17). The latter were developed in the 15th century so as to exhibit the trefoil arch on a small scale (*fig.* 18) by prolonging and notching the points between the counter lobes.

The archivolt of the pointed arch was at first entirely simple, and at most received an astragal for decoration. Afterwards it was covered with mouldings, with a view of disguising their true dimensions, and giving them a lighter appearance. The first decorative construction was the com-

bination of a socle, a scotia, and an astragal in front and behind, the two astragals lying close together (*fig.* 19). Subsequently a thin ridge was inserted between the two astragals (*fig.* 20), and finally the archivolts were profiled like the girt arches and cross-vault ridges (*fig.* 21).

The girt arches and cross-vault ridges always abut obliquely on their imposts. Owing to their limited width which never exceeds 8 inches, they are very simply profiled, mostly with sharp-edged astragals, scotias, and socles. The rich mouldings were all laid in the archivolt, which was sometimes very elaborately decorated (*fig.* 23). This degree of embellishment was the result of gradual improvement from the simple astragal (*fig.* 24); the twisted astragal (*fig.* 25); the wave line astragal (*fig.* 26); the zigzag astragal (*fig.* 28); the chevron (*fig.* 27); and combinations of two or more of these various forms. Such were the counter chevrons (*fig.* 29), and all the different ornaments which we have represented in *figs.* 30–40. The keystone at the point of intersection of the various vaults constituting a cross-vault was frequently made to project some distance below the plane of the vaults, and decorated with great splendor (*pl.* 40, *fig.* 39).

All these decorations reached their highest-point of perfection in the 13th century. They were then mostly borrowed from indigenous plants. The archivolts were often interrupted by trefoil arches and their upper edges decorated with erect foliage. In the 14th century the general jejuneness and monotony in decoration also affected the architectural mouldings; and in the 15th century the tasteful distribution of ornaments over the entire buildings was discontinued to make room for a meretricious decoration of single parts. Henceforth ornaments appear only on the outside of arches, doors, windows, and on the gables which were entirely covered. In these places and on the edges of the spires, decorative appendices, more or less tasteful, were made, consisting of leaves (*pl.* 39, *fig.* 1), flowers, dogs' heads, animal and human figures, &c.

Entablatures proper are not found in the pointed-arch style owing to the peculiar mode of construction which left no room for them. In the interior, only a cornice under the windows was retained, which varied in profile according to the individual taste of the architect. Some are found that approach the classic ages in noble simplicity. We have selected as an example a cornice from the cathedral at Avignon (*fig.* 2). On the exterior, cornices are more frequently employed as well at the gables as in the real or imitation interruptions that decorated the walls. These cornices were often supported by cornices (*pl.* 36, *fig.* 41) the shape of which was entirely matter of fancy; they are found from the simplest cubes to the most elaborate representations of animal or human figures. The cornices were also varied to suit personal taste and were sometimes exceedingly rich. This effect was, however, attained by introducing a greater number of members in the mouldings, rather than by a deviation from the simplicity which marks the style of decorating the cornices in this period (*pl.* 39, *fig.* 3). The recesses between pilasters were also closed above with two or more small arches resting on small consoles (*fig.* 4), which often had the form of

human or animal heads or figures (*fig.* 5). In the absence of consoles the cornices of the small arches were made to run uninterruptedly around the points between the arches, which in that case usually terminated in a flower.

In some churches horizontal decorations are found above the cornice, taking as it were the place of the architrave. They are either composed of burnt bricks exhibiting trefoil or quatrefoil recesses (*fig.* 6); or inscriptions chronicling some events or invoking the blessing of God upon the building; or else foliated work (*fig.* 7). These ornaments were also poorer in the 15th century (*fig.* 8); and in the 16th century they were frequently displaced by more or less happy attempts at imitating the antique entablature (*fig.* 9).

In the gables the arch decorations on consoles follow the slopes of the roof. The axis of the arch is perpendicular either to the slope (*fig.* 10) or to the horizon (*fig.* 11). The latter is considered better taste.

The roof commences over the cornice. It is either flat, or dome shaped, or a ridge roof. The decorations at the upper walls are different for the different kinds of roof. In the 13th and 14th centuries a gallery running all round the church was placed immediately below the roof. This gallery had a latticed or a decorated stone railing (*fig.* 13). Such were also placed at the edges of flat roofs. A similar latticed wall was also often placed as a decoration along the ridge of the roof, at first rather rude (*fig.* 12) but later more elegant, and in the 13th century superseded by gilt metal of elaborate workmanship (*pl.* 40, *fig.* 3). The edges of the roof frequently rested on consoles (*pl.* 39, *fig.* 14). This was especially the case with spire roofs which ascended very steeply. The decorations of the gables in the 11th and 12th centuries have still some affinities with the antique (*pl.* 40, *fig.* 5). In the succeeding century they are more like the earlier Byzantine (*pl.* 39, *fig.* 16), but in the prime of German architecture they are very tasteful (*fig.* 15). In this period little pyramidal turrets were placed at the foot of the gables on both sides.

The rain-gutters were arranged very cleverly in the middle ages and carefully lined with lead. Their spouts projected from the eaves in the shape of human or animal figures (*pl.* 40, *fig.* 4). Over them were the railings which we have mentioned, and which frequently were adorned with most beautiful circular rosettes or with lattice-work in the shape of trefoil arches over perpendicular compartments (*pl.* 39, *fig.* 17). These railings are always in accordance with the taste of their periods, so that a practised eye can from them determine the time when an edifice was finished. In some cases there are battlements with turrets at the corners (*pl.* 40, *fig.* 6) or machicolis (*figs.* 7, 8) instead of railings.

The walls were mostly very high and long, and especially in the prime of middle age architecture so thin that it became necessary to give them an outward support, partly in order to give them strength in proportion to their dimensions, in part to enable them to withstand the lateral pressure of the interior vaults. Buttresses were, therefore, employed as early as the Byzantine period. In the pointed-arch style buttresses and ascending arches were brought to the highest state of perfection. The first buttresses had but very little projection from the wall. They appeared almost like

pilasters (*pl.* 34, *figs.* 35, 36) and at the corners like half-columns (*pl.* 39, *fig.* 18). These reinforcements of the wall generally were carried up as high as the base of the cornice, and this height was retained even after they were considered as distinct architectural members, and received a greater projection (*pl.* 34, *fig.* 37). They were sometimes made round with a little conical roof (*pl.* 40, *fig.* 10), or connected at the top by arches (*pl.* 39, *fig.* 20). As church architecture advanced and the height of the vaults in the interior was increased, the projection of the buttresses increased in proportion; but as the pressure in the upper parts was gradually less, the buttresses were made of steps of different projections (*fig.* 19). When subsequently gracefulness in the appearance of the edifices received greater attention cornices were laid round the buttresses; and they received little gables (*pl.* 34, *fig.* 38) sometimes with ridge-roofs (*pl.* 39, *fig.* 22). A still more increased height of the nave led to another and stronger reinforcement of the walls. The side aisles, which were usually much lower, were girt with buttresses strong enough for the walls of the main nave. These buttresses were carried up considerably higher than the walls of the side aisles, and one or more one-sided or ascending arches were sprung from them against the wall of the main nave (*fig.* 21).

The decoration of the buttress consisted of columns at the corners, and the main cornices led around them (*fig.* 23). Above the cornice was placed a solid quadrangular pillar with imitation lattice-work, gables, and pyramidal point (*figs.* 24, 26). The less projecting buttresses received only a ridge-roof whose gable was decorated (*fig.* 25). Heavy buttresses, decreasing stepwise, had the façade of every step decorated with imitation lattice-work which gave them a lighter appearance (*fig.* 27). Their tops were then surmounted with solid pillars, whose front gables were supported by two small columns forming a niche between them in which a statue was placed. Sometimes, especially in England, a statue only was placed on the top of the buttress (*fig.* 28). Sometimes the buttresses had niches with gables from below upwards, this decoration being principally used on buttresses of towers (*fig.* 29). At the time of the *renaissance* all this elegant splendor disappeared, superseded at first by the rigid forms of the transition style, and then by the reversed consoles and other clumsy supports of the worst Italian style (*fig.* 30). In England polygonal buttresses are frequently met with surmounted by turrets with battlements, against which the ascending arches rest (*fig.* 31).

The windows that interrupt the walls of a church are either straight above, or arched, or entirely round. Their sides may be rectangular (*pl.* 40, *fig.* 11) or outwardly and inwardly oblique (*fig.* 12), or only inwardly oblique (*fig.* 13). The old basilicas have no windows in the apsis. At a later period the apsis had one or more, but always an *odd* number of windows. An even number only exceptionally occurs at a very late period. The great windows are properly a number of smaller ones packed into one frame, three or more lancet-windows being placed beside each other, and one or more foil or rosette windows above them or between their heads in order to fill out the arched cell of the vaulting, which then necessarily gave

the whole group an arched outline; and this was indicated by an arched drip-mould or label. It then became desirable to lighten the irregular-shaped masses of stone left between the perforations, and this was done by piercing these masses or spandrils, and reducing the solid frame of each foil or rosette to an equal thickness all round, as if several such frames or rings were packed into one great arched opening, which henceforth was regarded as *one* window instead of several.

The oldest windows are generally round-arched and more or less simple, as shown in *pl.* 39, *figs.* 32–36. Coupled windows (*fig.* 37) occur only in the first centuries of the middle ages. Among the earliest packed windows were those represented in *pl.* 40, *fig.* 9, consisting of three round-arched windows, the central one of greater width, with a common arch sprung over them all. The first round windows are of the same age, and occur between the heads of two coupled windows (*pl.* 34, *fig.* 25), but never alone. At a later period large rosette windows occur alone in the principal façades of churches, divided by little columns set around the centre like wheel spokes, and connected by round or trefoil arches (*pl.* 39, *fig.* 38). In the pointed-arch style the rosette window is always surmounted by an arch, or at least a drip-mould.

The improvement of the windows in the pointed style was as gradual as that in the Romanesque and Byzantine. We first find them small and simple (*pl.* 40, *fig.* 14); then coupled (*fig.* 15); next coupled with a perforated foil rosette between their heads (*fig.* 16); then the same arrangement packed into a common arch resting on columns (*pl.* 39, *fig.* 40). The desire for greater ornament made the windows more and more complicated, and designing the patterns for windows became a special art, the art of tracery. One centre mullion not being found sufficient to admit of many variations of design, three, five, and even seven were introduced. The mullions are usually perpendicular up to the level of the springings of the arch, where they diverge into arches, curves, and flowing lines, enriched with foliations. *Pl.* 40, *fig.* 17, gives an example of a window with three mullions; *pl.* 39, *fig.* 41, with five; and *fig.* 42 with seven. The division of the heads of the arches in these examples is strictly geometrical; the principal groups are separate, and each has its own appropriate subdivisions and ornaments.

The strictly *geometrical tracery* was in the 15th century superseded by the less beautiful but more lively English *leaf tracery* (*pl.* 40, *fig.* 20), and the still more lively French *flamboyant tracery* (*figs.* 18, 19; and *pl.* 39, *fig.* 39). According to Garbett's Principles of Design in Architecture, the difference between the flamboyant and the English leaf tracery is, that while the upper ends of the English loops or leaves are round or simply pointed, *i. e.* with *finial angles*, the upper ends in France terminate, like the lower, in *angles of contact* (those formed by two curves that have a common tangent). It was necessary to the leafy effect that the *lower* angles should be tangential, but to the flame-like effect that the *upper* ones should be so, even if the lower were finite; and hence some examples of flamboyant tracery turned upside down form a kind of leaf tracery.

The English, however, adopted still another method which was less conducive to the aspiring expression, and which conducted them to a style less rich and certainly less varied than any of the other After-Gothic styles. This style is called the *perpendicular*. Erroneously supposing that an abundance of vertical lines would increase the Gothic character, the English were led to convert all the flowing lines of the window tracery into vertical ones, to omit the capitals of nearly all the smaller shafts or shaftlets, thus converting what had been blank arcades into mere panels, and then to multiply, diminish, and extend these panels with endless repetitions of vertical lines over every part of the interior, and in florid buildings even of the exterior. Examples of this style are given in *pl.* 39, *fig.* 43, and *pl.* 40, *figs.* 21, 22.

Rectangular windows occur only in dwelling-houses or below pointed-arch windows, except in some cases in the period from the 13th to the 15th century, where they take the place of the gallery near the roof. The older quadrangular windows have highly ornamental jambs and lintels under arches (*fig.* 23). When they are very wide the lintel is supported by a column in the centre (*fig.* 24), or the upper courses of the side walls project under the lintel, thus approaching the flat arch (*fig.* 25) ; when their width is greater than their height, they are divided by mullions connected by trefoil arches under the straight lintel (*fig.* 26).

A curious combination of the Romanesque and pointed arch is produced by two Romanesque arcades intertwined, which at their intersections produce pointed arches (*fig.* 27) which are perforated for windows, and have a very pleasing effect. Windows of this kind were of frequent occurrence in the 12th century, but in the subsequent centuries their places were occupied by apparent perforations in the pointed arches.

Rosette windows occur as late as the 15th century, but their strictly circular form was gradually abandoned for convex-sided triangles (*fig.* 28) or polygons, with strictly geometrical divisions. Such windows of the purest taste are very numerous in Germany.

In the pointed-arch style of architecture doorways are striking and important features, indicating in the character of the mouldings and ornaments the style and period of the edifice. They are located either in the centre of the more or less decorated façade, or in some other point of the exterior wall. Only the former claim our special attention, the latter being generally very subordinate in character. The principal doorway of a church is always of the character of its windows, except in some cases where the erection has been of very long duration, when occasionally a later architect has been sufficiently deficient in good taste to vary the style with a view to satisfy his own fancy or the taste of his own period. The doorways are mostly perspective portals, deep enough to form forehalls, as we have already seen (p. 148). If the portal is very wide it is subdivided by a pillar in the centre (*pl.* 39, *fig.* 44), which is mostly adorned with the statue of the tutelary saint of the church. The door wings seldom reach to the top of the arch, but end mostly in a horizontal line at the height of its springings, the head of the arch receiving a packed window or merely an

indication of one in a profusion of sculpture. The greatest splendor of decoration prevails in the portals of the pointed-arch churches, as may be seen in the views of entire churches represented on *pls.* 34–39 and 41, of which we shall presently examine the details. The character of the sculptures found in and on the churches of this period will be described in that division of this work which is devoted to the Fine Arts.

As in the Romanesque style the apsis was the characteristic part of the church more or less decorated (*pl.* 40, *figs.* 29, 30), so in the pointed-arch style are the bell towers or spires. Their lower portion is usually a square elongated vertical building, or tower proper, which at a certain height passes into a circular or polygonal form, thence tapering off to a point, and forming a spire or steeple. In the absence of the tapering part they are called towers, otherwise spires or steeples. The bells are usually hung at the upper extremity of the tower below the commencement of the pyramidal part, and their position is exteriorly marked by the belfry window or other aperture for the escape of the sound. One of the oldest structures of this kind is the spire of St. Ainay's church in Lyons (*pl.* 40, *fig.* 31). A beautiful example of towers proper is afforded in the cathedral of York (*pl.* 38, *fig.* 20). Among the spires various kinds are distinguished according to their shape. Among them are the *pyramidal*, whose reduction to a point is step-wise, as in the Minster of Strasburg (*pl.* 36, *fig.* 42); the *arrow-headed*, whose reduction is in straight lines from the substructure to the point (*pl.* 34, *fig.* 39; and *pl.* 40, *fig.* 33); the *needle-shaped*, whose square substructure abruptly contracts into an octagon, the spire rising thence like the arrow-headed (*pl.* 40, *fig.* 35); the *dome-shaped*, whose corners are convex lines (*fig.* 34). *Gable towers* have no steeples, but framework roofs with two or four gables, and covered with tiles or slate (*fig.* 36). In conclusion we mention the *arch towers* which occur frequently on village churches. They are solid structures with several arched perforations in one of which the bell is hung (*fig.* 37).

The decoration of the towers in the 11th and 12th centuries consisted mostly of arcades arranged in different tiers above each other, and exhibiting principally the round arch. If the width of the arches was very great it was subdivided by subordinate arcades. The ornaments of the arches and their imposts, columns, consoles, archivolts, &c., were often exceedingly rich and always remarkable for unity of style to the minutest details. In the thirteenth century the round arches gave way for the pointed, and the towers had only one tier of arcades of great height, with deep perspective archivolts decorated with columns. In this century we find the first pyramidal stone roofs on towers, multifariously perforated with rosettes and foils. In the fourteenth century the mullions of the belfry windows are reduced to one, and the spaces filled out with sound-boards (*pl.* 40, *fig.* 32). On the other hand new decorations are introduced on the columns, arches, and gutter-spouts, giving the towers a much richer appearance. In the 15th century towers commence to be built of several stories of gradually reduced circumference, and richly decorated with buttresses, ascending arches, crowning flowers, &c., and harmonizing in surpassing splendor with the

style of the churches to which they belong. *Fig.* 38 *a* represents the upper part of such a tower. The workmanship is exquisite, but the arrangement of the ornaments already denotes a grievous deviation from a natural perfection, as is more clearly seen from *fig.* 38 *b* representing a massive turret placed on a very slender column.

The pointed-arch style is generally designated as the Gothic style. With much more truth and propriety it might be called the German style as has been proposed by Goethe, for it originated in Germany and has in its characteristics nothing in common with the older styles that we have examined in the preceding pages, and least of all with the real Gothic style which originated in Italy during the supremacy of the Goths in that country under Theodoric. The prominent original features of the German style are: 1. The construction of cross-vaults whose ribs alone are of freestone, grouped in the greatest variety of forms, the spaces between them being filled up with bricks not more than four to eight inches in size. 2. The pointed arch over windows and doors. 3. The connexion of pillars and columns in the interior by pointed arches. 4. The extremely high naves and remarkably slender columns and pillars that support their cross-vault ceilings. 5. The profusely decorated perspective portals. 6. The highly finished perforated work in the high spires. 7. The proportionately thin walls of exquisite masonry, strengthened by buttresses at the points of lateral pressure of interior vaults.

The oldest monuments of this style date from the 10th century, and are found in the very heart of Germany between the Elster and Saale Rivers, near the Elbe, where it would be absurd to suppose Romanesque, Byzantine, or Moorish influence, when the vast tracts of land that separate their site from the homes of these latter styles remained entirely unaffected, and had no buildings in the *so-called* GOTHIC, *properly* GERMAN pointed arch style until a century later. The fact that the church of St. Peter and St. Paul in Zeitz, dedicated in the year 974; the cathedral of Meissen, commenced in 948; the cathedral of Merseburg, commenced in 968, and others which are in the purest pointed-arch style, are much older than any edifice of this style in France, England, Italy, and even in the rest of Germany, seems conclusively to prove that the pointed-arch style was invented and first employed in Saxony. It is therefore purely German, and it is a misnomer to call it Gothic.

Having thus given an outline of the progress and development of Architecture during the period of the pointed-arch style we offer in conclusion a short description of the most prominent of its monuments.

1. THE MINSTER OF FREYBURG IN BADEN. (*Pl.* 35, *fig.* 16, plan; *fig.* 17, view). This remarkable church was commenced in the year 1122. Its construction was prosecuted with great zeal on the part of the princes and citizens, the latter mortgaging their property in order to raise money for the church. In the year 1146 it was so far completed that Bernard de Clairvaux could preach in it and exhort the people to join in the crusade. The edifice then, however, only comprised the tower A, the nave B, with the side aisles C C, and the transept D, to the small tower *d*. The spire

was finished in the 13th century. The choir E, with the gallery F, was commenced in 1314, and finished in 1513 by John Niesenberger of Gratz. Erwin von Steinbach, the architect of the Minster of Strasburg, was also for some time engaged in superintending the Freyburg building. The transept appears to be the oldest part of the church since it exhibits a mixture of the Byzantine and German styles, whilst the rest of the building is in the purest German style. The width of the nave is 27 feet, that of the side aisles 20 feet. The ceilings are simple cross-vaults resting on columns 7 feet thick. The walls without the buttresses are only 6 feet thick. The choir is closed on three sides and has cross-vault ceilings with very artificially distributed ribs. Its length is 157 feet; that of the nave 175 feet. The façade has a beautiful perspective portal (1), 30 feet in width, lying between pillars of 8 feet thickness and 13 feet projection, and profusely decorated with columns, arches, and a gable with fine sculptures. The fore hall A is also rich in architectural ornaments and sculptures. The inner doorway (2) has a central pillar decorated with a statue of St. Mary. The vault of the fore hall is 42 feet high. The tower is square up to the first gallery; thence twelve-cornered; and finally eight-cornered up to the base of the pyramid which is six-sided and rises, without nucleus and with beautifully perforated walls, a pattern of the most exquisite architectural construction. Its extreme height including the substructure is 372½ feet. The height of the nave is 82¼ feet, and the choir has the same height, but it appears higher exteriorly as it is elevated by a number of steps above the floor of the nave. A number of chapels, *e*, are grouped around the choir. The cross-arms have each a portal surmounted by perforated pyramids, and the richly decorated buttresses of the side aisles are connected with the upper wall of the main nave by ascending arches which strengthen it. The south side is very rich in sculptures, and all the windows contain most beautiful glass paintings. The pulpit is of stone, and a masterpiece of sculpture by George Kempt.

2. The Minster of Strasburg (*pl.* 36, *fig.* 42, view from northwest). This edifice is one of the most precious monuments of German architecture. The entire structure is of a hard white freestone, slightly tinged with red. Its extreme length is 343 feet 4 inches, in the clear 314 feet. It has three aisles of an aggregate width in the clear of 114 feet, 6 inches. The transept is 173 feet, 8 inches long, by a width of 44 feet, 7 inches. The nave is 42 feet, 4 inches wide, and 95 feet, 5 inches high. The twelve clustered pillars which separate it from the side aisles have a thickness of 7 feet, 4 inches; their inner cylinder is 5 feet, 3 inches in diameter. The side aisles are 24 feet, 11 inches wide, by a height of 43 feet. The tower façade is 159 feet, 6 inches wide. The side walls are only 3 feet, 8 inches thick, with buttresses 4 feet, 4 inches broad, and projecting 8 feet, 6 inches. There are two side chapels, 51 and 56 feet in length, attached to the side aisles. These chapels have artificially distributed vaulting ribs, whilst the other ceilings are simple cross-vaults with caps 8–9 inches thick. The western side of the interior has beautiful German ornaments among which two rosettes are prominent, the one with apparent perforations, the other a

true lattice window 51 feet in diameter. The intersection of the nave and transept is surmounted by a dome. The choir, which belongs to the oldest part of the church, has been restored in inferior style. This oldest portion, which embraces also the cross-arms with the exception of the northern portal, which is of later date, is built in the Byzantine style. Under the choir is a subterranean church, and 21 feet below the latter is the foundation sole of the minster, being a layer of clay 3 feet thick on closely driven piles. Near one of the chapels is a small court containing a stone cube with the epitaphs of Erwin von Steinbach (d. 1318), the architect of the spire and of his wife and son. The tower was commenced in 1277. Its height to the platform where the warder lodges, is 205 feet from the floor of the church. Thence rises the northern tower. The southern was never built. This part of the structure is a quadrangle with truncated corners, 113 feet, 6 inches high, and containing the belfry and spiral stairs. From its top rises the spire proper, a pyramid 121 feet, 6 inches high. The total height of this spire is, therefore, 442 feet. It is the highest finished spire in Europe. The spires for the cathedral of Cologne were designed to be 532 feet high, that of the minster of Ulm 452 feet, 6 inches, but they were not completed. The upper pyramid of the Strasburg spire is octagonal and reduced stepwise to a point. It is of the most exquisite workmanship, and built according to the highest principles of stone-dressing. The gallery below the cross forms a sort of crown to the spire. The spire was executed under the superintendence of the architect John Hültz, and its every detail commands the admiration of architects in point of construction.

The southern portal is in the Byzantine style. It is decorated with sculptures representing figures from the Old and New Testaments and others distinguished by tasteful composition and beautiful execution. They are newer than the portal itself, and are principally works of Sabina von Steinbach, daughter of the architect. This portal formed the conclusion of the oldest portion of the church, which was all finished in the year 1002. The outer walls of the new naves were finished by bishop Wernher in 1028. It is in the pointed-arch style of much lower dimensions than were afterwards in vogue. The vaulting of the nave and side aisles was not completed before 1050. Erwin von Steinbach constructed the ascending arches to the walls of the main nave and built the tower to the height of the ridge of the nave. After his death his son John carried it up to the platform. He was followed by John Hültz of Cologne, who commenced the northern spire and built a piece of the southern, which was subsequently taken down. Conrad Frankenberger was the next architect. He worked at the northern spire for the first four or five years of the 15th century. Finally John Hültz, grandson of the above mentioned Hültz, finished the pyramid in the year 1439. The stone pulpit is of exquisite workmanship and was wrought by Hammerer in the year 1485.

3. The Cathedral of Cologne. No building has been so much discussed in public prints and special books as the cathedral of Cologne. It has the greatest claim to the special attention of architects, on the one hand by the merit of its grand and harmonious ground plan, and on the other because

its architectural forms and ornaments are so many witnesses of the prime of the pointed-arch style. *Pl.* 34, *fig.* 40, gives a view of this building as it is intended to be when completed. Six hundred years have elapsed since it was commenced, but no part of the grand structure is entirely finished. In the beginning of the present century many of the finished parts showed serious marks of decay, and it became a point of pride in all the German nation to prevent the ruin of this cathedral, and if possible to complete it. In 1824 the Prussian government decreed an annual contribution of $10,000; a light cathedral tax was created, to which every man had to bring his mite; extensive private collections were made, and numerous presents and bequests sent to the cathedral. The king of Bavaria set the example of having certain parts of the building finished at his own expense, and several other princes and associations followed it. The work was then commenced in good earnest, and has been carried on ever since. The restoration of dilapidated parts and the new parts are being made strictly in the spirit and according to the designs of the first architect. Fortunately the original plans still exist, so that no room has been left for mistakes by erroneous conclusions. But the astonishing elaboration of ornament makes progress very slow. There is hardly a stone laid in the building that has not on one or more of its faces highly finished stone-dresser's or sculptor's work. The progress of decay has, however, been effectually arrested, and considerable work has been done towards the perfection of the cross-arms with their magnificent portals. The side aisles have been furnished with painted-glass windows of the highest artistic value, presents of the king of Bavaria, representing the birth of Christ, the Evangelists, and other subjects illustrating the Scriptures. The main front where the two spires are to be reared is still pretty much in its dilapidated condition. The northern tower is only 10 or 15 feet out of the ground; the grand portal between the two towers is not even commenced; and only the southern tower is carried up two stories and a half to about the height of the projected peak of the centre gable, which is to have the height of the main nave. On this tower stands the token of Cologne, a huge unwieldy wooden crane, used for raising the blocks of stone to their proper places. In the course of centuries the inhabitants of Cologne had become so strongly attached to this crane, that they replaced the old time-worn one in 1826 by a new one, at an expense of nearly $20,000, although the final completion of the edifice would have been much more furthered had this sum been judiciously expended in some other part of the building. The entrance to the church, at present, is through the side portal in this tower leading into the southern side aisle.

The construction of the church was commenced in the year 1248, when the archbishop Conrad of Hochstedten laid the corner-stone on the eve of St. Mary's day. The plans are ascribed by some to Gerhard of St. Trond, who appears in the accounts as a master stone-cutter: by others, to Albertus Magnus, Dominican monk, and subsequently bishop of Ratisbon. The latter conjecture seems to have the greater probability, for the thoroughly digested plans would appear to be beyond the conception of a

mere stone-cutter, whilst Albertus Magnus is known to have been the designer of the magnificent cathedral in Ratisbon. Archbishop Conrad died in 1261, and the city of Cologne was under the curse of the papal anathema for a number of years. The construction was therefore interrupted until 1305, when it was taken up again. In 1320 the choir was consecrated for church service. Since then down to 1824 very little has been done to the edifice, which thus has been exposed for five hundred years in an unfinished state to the inclemency of a wet climate. As it stands now, it might be completed in a comparatively short space of time, if there were unity of action and a wise concentration of means; but the political state of Germany, weakened as it is both in moral and material strength, leaves very little room for hope that more will be done hereafter than has been done for the last twenty years; and, although the pious spirit in which the work is conducted commands the most unqualified appreciation, the rate of progress excludes all belief of its ever being brought to an end.

In the arrangement of the ground plan the number of SEVEN seems to have constituted the leading idea. *Seven* columns line each side of the main and side entrances. *Seven* pedestals for statues are on either side of the fore-hall. The southern tower has *fourteen* corner canopies. *Seven* pairs of columns on either side separate the fine aisle of the church to the foot of the high choir. The latter contains also *seven* pairs of columns, and is surrounded by *seven* chapels. The entire church has *fifty-six* free columns and *twenty-eight* pilasters. All the dimensions are also resolvable by the number of *seven.* The height in the clear of the high choir is 161 feet, equal to that of the width of the church. The western portal is 231 feet wide, equal to the projected height of the gable. The projected height of the spire is 532 feet, equal to the entire length of the church, including the buttresses and the fliers. The height of the side aisles in the clear is 70 feet; the width of the cross-arms, which have three aisles, 105 feet; the depth of the fore-hall 56 feet, &c. It would probably be easy to trace the combination of *seven* into the most minute details of the ornaments. These are arranged in the purest taste, and executed with surpassing skill. We have copied a number of them on *pl.* 41; *figs.* 1–4 are capitals from the columns placed in front of the principal pillars; *fig.* 5, a capital from a pilaster; *figs.* 6–8, ornaments from different galleries; *figs.* 9, 10, medallions from keystones of vaults; *figs.* 11, 12, water-spouts. The walls of the side aisles are 4 feet 8 inches thick, and reinforced by buttresses of 11 feet projection by 8 feet breadth. According to the plans, double ascending arches are to be sprung from these buttresses to the higher walls of the main nave, which are to be erected on the pointed arches connecting the main pillars lining the nave. The entire church covers an area of 69,000 square feet. In size it is the ninth Christian church. It is to St. Peter's in Rome as 1 : 2.866. Its foundations are more than 40 feet deep. At present, about one third of the masonry is completed, if we include the projected spires in the calculation.

4. ST. STEPHEN'S CHURCH IN VIENNA. The first Duke of Austria, Henry

Jasomirgott, laid the corner stone of St. Stephen's church in the year 1144 or 1147 (the chronicle being illegible) on the site of an old chapel. The design was made by Bishop Reginbert, of Passau, and the construction conducted by the architect Octavianus Wolzner, of Cracow. Of the original edifice nothing remains but the walls of the central nave and the western façade, with the gigantic portal in the Romanesque style. All the lower part of the western front shows the perfect Romanesque style, whilst the pyramids of the towers exhibit the beginnings of the pointed-arch style. In the years 1258 and 1275 the church suffered considerably by conflagrations, but was repaired as early as 1278, when the Emperor Rudolph I., of Hapsburg, celebrated in it his thanksgiving for his victory over Ottokar of Bohemia. The re-edification and enlargement of the church in the pure pointed-arch style was completed by Anthony Pilgram, in 1313, by the designs of Bishop Peter of Passau, or rather of Parson Bernhard Brambeck, who subsequently became Bishop of Passau. The vaults of the nave and side aisles, as they now stand (*pl.* 37, *fig.* 25), date only from 1574; the previous ones had no artificial ribs. The high choir was finished in 1339, by Duke Albert, with money raised by a tax of two cents on every subject. The designs for the spires on the cross-arms were made by the architect Hauser, of Kloster-Neuburg. A second Anthony Pilgram conducted the building in 1400, and completed the southern spire in 1433. The northern tower was in 1511 carried to the height of the church roof (145½ feet) by John Buxbaum. In 1514 the spire was struck by lightning, and inclined considerably to one side. It was righted in five years by the architect Leonhardt. Subsequently it settled again about three feet to the north-east. In the years 1839-1842 about 70 feet of its top were taken down, re-erected perpendicularly, and crowned with a gigantic flower, embossed of sheet iron. Its extreme height is 428 feet 8 inches. The length of the church is 321 feet. The main nave between the pillars, which are 8 feet thick, is 29 feet wide; the side aisles 25 feet. The height in the clear of the central vaults varies from 76 to 85 feet. Its area is 46,866 square feet. It is to St. Peter's in Rome as 1 : 4.14. The spire is one of the most daring structures, its height being to its area as 9.5 : 1, and its lower walls only 8 feet 10 inches thick. The foundations of the church are said to rest on huge subterranean vaults five stories deep, the three lowest of which are never opened, whilst the two uppermost ones serve as sepulchral vaults, in which bodies do not decay but dry up. The corpses are deposited in chambers between pillars, which are walled up as soon as they are filled. Between these chambers galleries lead to the imperial vault in the centre, where since Ferdinand II. the intestines of the royal family are deposited in copper urns, their hearts being deposited in the chapel of Loretto, in St. Augustin's church, and their bodies in the church of the Capuchins.

5. The Cathedral of Magdeburg. This edifice was commenced as early as 963 by Emperor Otho I., in the favorite city of his empress Edith, who was also buried in this church. This cathedral was a masterpiece of architecture in the pure Byzantine style. It was entirely destroyed by fire

in 1207, nothing remaining but the walls of the high choir, which were made use of in the re-edification which had commenced already in 1208, after the designs of the architect Bohnensack. *Pl.* 41, *fig.* 13, represents its ground plan, *fig.* 14 gives a front view of the edifice from the north-west side. It is in the purest German pointed-arch style. It was finished in little over 150 years, being consecrated in the year 1363. Its length in the clear is 288 feet. The vaults of the main nave, which rest on 22 columns connected by pointed arches, are 106 feet high, those of the side aisles 30 feet 8 inches. The choir contains several statues and porphyry columns said to have been sent from Italy, and to have belonged to the old building. The church is one of the finest edifices in northern Germany, and of high value for the study of the architecture of the middle ages, being one of the few works of those times that are entirely finished. It suffered to some extent during the several sieges of Magdeburg in the Thirty Years' War, when especially the southern spire lost its crowning flower and suffered considerable damage to its interior decoration. In the year 1826 it was repaired by order of the King of Prussia, strictly in the style of the first design, and the church has now a noble appearance both exteriorly and interiorly. The façade of the towers, with the magnificent portal between them, is admirably composed. The fore hall contains the bronze monument to Archbishop Ernest of Magdeburg, cast by Peter Vischer of Nürnberg, when the archbishop was still in life. At the beginning of the northern cross-arm is a remarkable parabolic vault with horizontal joints, constructed very much like the treasury of Atreus in Mycenæ (p. 34 and *pl.* 8, *fig.* 8). In the transept is a beautiful chapel forming half a dodecagon, whose flat ceiling rests on perforated girt arches.

6. The Church of St. Michael and St. Gudula in Brussels was commenced in 1047 and enlarged in 1295. It is built throughout in the purest German style. *Pl.* 37, *fig.* 23, gives the western view of the church. It has three portals leading into the three aisles, the central one of which is 130 feet high and 34 feet wide, its vaults resting on 12 round columns four feet in diameter, in front of which stand the statues of the twelve apostles. The side aisles are 50 feet high and 20 feet 6 inches wide, including the chapels. The choir is about 86 feet high and lined with round columns. Over the intersection of the nave and transept is a pointed wooden spire. The upper walls of the main nave rest on the pointed arches that connect the columns, and are secured from without by double rows of ascending arches, sprung from the outer buttresses over the side aisles. The choir has no such ascending arches, being much lower than the nave. The choir is ornamented by ten broad windows, more than 50 feet high, and decorated with highly finished glass-paintings. It has also 20 attached chapels. The interior of the church is magnificent. The main front, however, is incomplete, the towers having been left without their spires, and although of the same height, both unfinished at the top.

7. The Cathedral of Antwerp (*pl.* 37, *fig.* 24, western view) was first built in the 13th century, and dedicated to the Virgin Mary. It was destroyed by a conflagration, only the choir and the façade of the towers

being saved. The new nave was built in 1422 by John Amel on the old foundation. It is 490 feet long, 228 feet broad, and 154 feet in the clear, and is one of the most beautiful structures in the Netherlands. The vault over the intersection of the nave and transept supports a beautiful dome with a wooden cap. The new choir was not commenced before 1521, when Charles V. laid the corner stone. The portal and the northern spire were finished in the year 1518, whilst the construction of the southern tower was interrupted as early as 1515. The northern spire is 447 feet high, with a cross of 15 feet in height, and is by many preferred to the spire of the Minster of Strasburg. The unity of style in the latter gives it, however, a decidedly greater merit, the upper part of the spire of Antwerp deviating from the pure pointed-arch construction. Upon the whole the western façade exhibits too much of the meretricious ornament of the 16th century to be ranked with the Minster of Strasburg, whose entire ornaments are purely constructive and therefore true.

The ground plan of the cathedral of Antwerp is in the form of the Latin cross. The width of the church is divided into seven aisles, the central one of which is 31 feet in the clear. Its pillars are 5 feet 6 inches thick. The first side aisles north and south are 19 feet wide, with pillars 3 feet 7½ inches thick; the second ones are 12 feet 2 inches wide, with pillars of 5 feet 1 inch in diameter, on which rest also the vaults of the northernmost aisle, 21 feet 8 inches wide, and of the southernmost aisle which is 27 feet wide.

8. The Cathedral of Notre Dame in Paris, dedicated to the Virgin Mary, is one of the most remarkable edifices in France both in point of design and of execution. Its corner stone was laid in the year 1163 by Pope Alexander III., and the choir with its gallery was finished as early as 1177. In the year 1183 the vaults of the main nave were closed and the main altar was dedicated; and three years later the choir was devoted to public worship. So far the church is in the Romanesque style, and the Romanesque pedestals for the columns in the naves and transept indicate that these parts were commenced by the same builders.

At the time of St. Louis's advent to the throne of France (1226) the nave and side aisle were already considerably advanced. The two towers, however, and the middle building which they flank, belong to the last quarter of the 13th century. The southern portal was commenced in the year 1257, together with the northern and the chapels around the choir. The entire process of construction lasted 170 years.

The ground plan of this cathedral is given in *pl.* 40, *fig.* 1, and *fig.* 40 is an interior view of the same. It is in the form of a Latin cross, and has five aisles whose vaults rest on seventy-five columns. Its length is 390 feet by a width of 144, and a height in the clear of 102 feet. It has two square towers, which are only 204 feet high, having flat roofs at the height where the pyramidal spires ought to have commenced. The columns in the centre aisles are surmounted by pointed and those of the choir by round arches, on which rest the upper walls of the main nave. These walls are interrupted by the arcades opening from the galleries over the inner side aisles. The windows through which the main nave is lighted are above these gal-

leries. The church has the total number of one hundred and thirteen large side windows, and three large rosettes over the three western portals. The greater proportion of these windows are adorned with fine glass-paintings.

9. THE ABBEY OF ST. DENIS. The church of St. Genevieve belonging to the Abbey of St. Denis was built in the Byzantine style in the year 628–630. It fell down in 1160. It was re-erected in the pointed-arch style by Abbot Suger in the years 1251–1281, who had designed the plans himself, being an expert in all the fine arts. The crypt under the old choir, which is the sepulchre of the Kings of France, was retained unchanged (*pl.* 41, *fig.* 18). It is in pure Byzantine style, its vaults resting partly on thick columns, in part on square pillars. At the time of the first French revolution it contained the remains of twenty-five kings, ten queens, and eighty-four princes and princesses, which were disturbed by the mob and buried in the neighboring churchyard. Louis XVIII. caused the chapel to be re-consecrated. In his restoration of the monuments, the old statues were laid on the corners of the sarcophagi instead of being left standing near them as before. The upper church is not very remarkable, and does not claim special notice more than a thousand other buildings in the same style.

10. THE CATHEDRAL OF ROUEN. Another remarkable church in France is the Cathedral of Notre Dame at Rouen, also called the church of St. Ouen from the bishop of the same name. *Plate* 39, *fig.* 45, gives the view of the chief portal, with the market-place in front. It is built in the German style and is cruciform. Its extreme length is 390 feet, the inner 366, that of the transept 162, the breadth of the main aisle 27 feet 9 inches between the clustered columns, which are 6 feet 7 inches to 7 feet 4 inches thick, and stand 9 feet 7 inches apart. The width of the middle space between the four chief pillars, which are 12 feet 6 inches thick, is 21 feet 7 inches. The fourteen round columns of the choir are 3½ feet thick and 36 feet high, and the height of the main aisle and the choir is 84 feet; that of its gallery and of the side aisles is 52 feet. In the nave there are two rows of arcades, one above another, although there is but one side aisle on each side, and a side gallery stands also in the choir under the high windows.

On the western front, which has three portals perspectively arranged, and which is ornamented with fine sculptures, and whose middle portal is crowned with a handsome gable, stand two towers 230 feet high. Over the middle portal is a great rosette, which is represented in *fig.* 39, and contains very handsome painted glass. Formerly the church had another tower over the cross, which was destroyed by fire in the year 1822. It was replaced by an iron spire 276 feet high. The transept has two portals. The southern one is perspectively arranged and is crowned with a pointed, pierced gable, over which is a great rosette, over which again stands a gable which leans against the buttresses. The northern portal has two buttresses in the form of towers, and also a rosette crowned with a beautiful gable.

Besides these three great rosettes, the church has 130 windows, of which, however, only those in the high choir and in one chapel have painted glass.

From the exterior buttresses, ending in tasteful pyramids, ascending arches are sprung to the buttresses of the main aisle, the prolongation of the clustered columns of the interior. These buttresses rise with their rich pyramids above half the height of the roof. Galleries extend around the roof.

In Rouen the Gospel was first preached in the year 260, by the English missionary, Melon, and in 270 a church was erected upon the site of the present cathedral. It was renewed in the year 400 and beautified in the middle of the 7th century by the Bishop St. Ouen, but was destroyed by the Normans. When their Duke, however, was baptized he rebuilt the church, which the son of the third Duke, Robert, Archbishop of Rouen, enlarged. The side aisles were added in 1050 and completed in 1063. In the year 1200, when Rouen was destroyed by fire, the church also suffered, and only the under part of the walls remained standing, upon which the present church was erected in the pointed-arch style. The western front was commenced in the 13th century. The architect of the three portals was a German, Ingeram, who also enlarged the eastern chapel, and in 1280 erected the perforated gable over the portals. The northern portal was completed in 1478, and three years afterwards the court before it, which exhibits much of the Arabian form. The upper part of the northern tower was built in 1468–77, the southern 1496–1507.

11. The Cathedral of Milan. No building indicates more clearly than the Milan cathedral the position occupied in Italy by the Germans during the middle ages. The sketch was made by Henry Arter of Gemünd, who had gone to Bologna and was there called Enrico da Gamondia. His son, Peter Arter, under the name of Pietro da Bologna, directed the building of St. Vitus's church in Prague, and his father sketched the plan for the Minster in Ulm. Upon the site of the present Milan cathedral stood a splendid church, with a bell tower 448 feet high, which Frederick I. caused to be destroyed. In 1386 the corner-stone of a new church was laid under Galeazzo Visconti; but it was too small, and in place of it, in 1391, the building was commenced from the sketch of Henry of Gemünd. When Henry returned to Germany, Italians were elected architects; but as the work reached the dome and the pyramids, the Italians were again at fault, and Duke Galeazzo Maria Sforza wrote in 1486 to the building guild of Strasburg for a German architect. Hans Niesenberger, of Gratz, who since 1471 had superintended the building of the Freyburg Minster, went to Milan, accompanied by his son John and German workmen. He appeared there under the name of *Giovanni da Gratz, Ingenere di Allemania.* He arranged matters there and returned to Germany, while Francesco di Giorgia da Siena, Antonio Omodeo, and Jacopo Dalzebono undertook the execution of the German design. Besides those already mentioned, the following Germans had assisted in the work: John Anex von Fernach, Ulrich von Frisingen from Ulm, and Jacob Cova from Bruges. The cathedral itself was only gradually completed, and after a great number of architects had worked upon it, the point upon the pyramid over the dome was finally placed by Francesco Croce in 1762–72. On the 16th of August,

1806, the architect Amati received the command of the Emperor Napoleon to complete the façade and to cover the cathedral itself with white marble. It is not entirely completed even now.

Pl. 40, *fig.* 2, shows the ground plan, and *pl.* 38, *fig.* 21, the interior of this magnificent church. The length of the interior between the walls is 448 feet 6 inches, the wall of the choir is 6 feet, and with the piers 12 feet thick. The thickness of the front wall is 15 feet 8 inches, consequently the whole length is 476 feet 2 inches. The length of the transept is 283 feet, and the inner length of the nave 175 feet. Measured between the columns the main aisle is 52 feet 4 inches, and each of the side aisles 21 feet 7 inches. Of the 52 round columns in the interior of the church, 48 are 7 feet 6 inches through, and the middle ones 8 feet 7 inches. The height of the nave is 147 feet 9 inches, consequently 3 feet 9 inches greater than the height of St. Peter's, and it is the highest aisle in any existing church. The height of the inner side aisles is 97 feet, and that of the outer ones 75 feet 4 inches. The ribs of the vaults are of marble and are 8–12 inches thick; the caps are vaulted in brickwork and are 3–6 inches thick. The construction of the dome over the middle of the church is very remarkable. It rests upon the four middle piers and the arches uniting them, and is raised 201 feet 6 inches over the floor of the church. The lantern placed upon it is 34 feet high, and upon this rests the spire or the pyramid of 92 feet in height, upon which stands the statue of the Madonna, 12 feet high, so that the whole is 339 feet 6 inches high. This dome is 54 feet broad, 43 feet 10 inches high, and forms an oval with eight principal ribbed arches, whose caps are walled in brick. The exterior is richly ornamented with pyramids and pillars, many of which support statues. The cathedral was to have had portals in the cross-arms, but little chapels were introduced instead.

The western façade has five doors, of which the middle one is 15 feet 4 inches broad and 30 feet 8 inches high. The doors and the windows over them are arranged by Pellegrini in the Italian taste. Besides these, there are three large windows in the old German style on this façade. Between the doors and upon the corners, there are richly ornamented buttresses, which are crowned by pyramidal pillars reaching 66 feet above the eaves of the roof. Of these there are several hundred upon the church. The number of statues is estimated by some as high as 4500, and 3000 is certainly not an exaggerated estimate.

The effect of the interior is in the highest degree superb and wonderful, not only from the great size, but from the loftiness of the nave, the beautiful and naturally warm colors of the material, and the soft illumination through the great painted windows. The 52 clustered columns of the interior were to have had their capitals crowned with statues, but the figures are completed upon a few only, as our view shows.

The roof is striking; for in place of the former tile roofing, white marble slabs 1½ to two inches thick have been laid upon little flat vaults, avoiding the necessity of rafters, and in fact there is no wood used in the building. The plates of the roof are jointed with a very compact water-proof cement.

The cathedral has a crypt, which is 45 feet in diameter and 15 feet high, and is lighted from the church through openings in the vault.

12. The Church of St. Cyriacus in Ancona. As a specimen of this period, even if not of the purely pointed-arch style, we must mention the church of St. Cyriacus in Ancona, of which *pl.* 46, *fig.* 21, gives the ground plan, and *fig.* 22 the section. This church was commenced in the 11th century, and the ground plan forms a Grecian cross whose whole length is 155 feet, but the length of the transept extends, on account of the two apsides, to 182 feet. The central nave is 22 feet 6 inches wide, and 45 feet high; the whole church is 59 feet broad, but the transept only 57 feet. The height of the dome is 78 feet. The building itself is of the Byzantine style, and was completed about the year 1290 by Marchiano, a pupil of Arnolfo da Lapo. Many of the interior columns have antique Ionic capitals as pedestals, and their own capitals are of a meagre Corinthian style. Under both apsides there are little crypts. The points between the ribs of the dome are very peculiar, containing small arcades.

13. The Church of the Convent of St. Simon in Palermo. The capital of Sicily is rich in remarkable monuments of the middle ages, which, almost without exception, offer a peculiar blending of the Moorish with the German pointed-arch styles. From this fact some have ascribed the origin of the German style to the Moorish, but certainly very incorrectly, as all the buildings which show this mixed style date from the 14th and 15th centuries, and are consequently of much later date than the origin of the German style in Saxony. The blending of the two styles is perceptible, especially in the ornaments, many of which, as for example the Palatinal Chapel (built in the 15th century), are copied from the highly characteristic ornaments of Alhambra in Granada. On the other hand, it is shown in the overtopped pointed arches, which are not set upon clustered columns, but upon slender pillars whose capitals are rather projecting, whilst the vaults themselves are dome-shaped, rarely cross-vaults.

The arches, as well as the vaults, are rich with glowing paintings, often upon a gold ground, as are found also in Alhambra. The walls also are richly ornamented with stucco. In illustration we present an interior view of the church of St. Simon in Palermo (*pl.* 41, *fig.* 16). This church was built in the year 1449, and is distinguished by the beauty of its marble columns and the richness of its paintings.

14. The Cathedral of Burgos. This cathedral, of which *pl.* 38, *fig.* 22, represents the western view, is distinguished by its construction and the history of its erection. It was built by Ferdinand III., consequently in the first half of the 13th century, on the site of a mosque erected by Abdorhaman in 1014. Its length is 300 feet, and that of the transepts 212 feet. It is entirely in the German style, and divided into three aisles, the main aisle being supported by ascending arches, sprung from the side buttresses. The cross-arms have portals with large, finely ornamented rosettes, over which stands a gallery, between two buttresses crowned with pyramidal pillars. Upon the intersection of the transept with the nave

stands an octagonal tower in the old German style, surrounded with pyramidal pillars. The western façade has on each side a tower 300 feet high, with perforated spires. These spires are formed by 8 ridges meeting under the balls, which are ornamented by crowning flowers, and they are bound together by 24 horizontal ribs, at various distances from each other. In respect of construction, these pyramids are most like the towers in Freyburg, in Baden, and those of the church of St. Mary in Esslingen, but they are very inferior in composition and elaboration. In the panels formed by these ribs stone cross-joints are introduced. The portal is perspectively arranged, and there is a round window over it, under a pointed arch. A round window is introduced below the spires on each side of the towers, which resembles the windows of some of the old Rhenish churches, the Bonn cathedral for instance. These towers were built soon after 1442 by the architect John of Cologne and his son Simon, whom the bishop had taken with him from their native country. Under Charles V. the transept of the church was repaired. The same two German architects built the charter-house Miraflores near Burgos.

15. The Minster at York. After the modern St. Paul's church in London, of which we shall presently speak, York Minster is the largest of English churches. *Pl.* 38, *fig.* 20, gives a view of its western front. With its three aisles and the transept divided into as many, it forms a Grecian cross. The exterior length from west to east is 578 feet. The central nave is 43 feet, 6 inches wide, between the clustered columns, which are 7 feet, 3 inches thick, and 27 feet high, and stand at distances of 20 feet. The side aisles are 20 feet, 6 inches wide. The cylinders of the two clustered columns supporting the towers, are 9 feet, 6 inches thick. The four great piers bearing the middle tower, which are surrounded by 27 half and three quarter columns, are 21 feet, 7 inches thick, and stand in the transept at distances of 27 feet. This transept is 45 feet wide, and its side aisles 20 feet. The choir is 44 feet, 6 inches wide between the piers, which are 7 feet, 9 inches thick. The thickness of the side walls is 4 feet, 9 inches, and the buttresses project from 6 to 9 feet long, and are 4 to 5 feet broad. The height of the nave is 92 feet, 6 inches, that of the side aisles 48 feet. The middle tower over the cross is 198 feet high from the church floor, and its walls are 6 feet, 9 inches thick. The light falls through its windows into the centre of the transept. The front towers, or the two westerly ones, are 172 feet high from the church floor to the highest gallery. The pyramidal pillars upon them, eight upon each tower, are 24 feet high. The great buttresses of the towers project 10 feet before the walls, and are 79 feet high. The walls are 8 feet thick. The point of the gable over the door is 35 feet, that of the front chief gable 100 feet, and the pyramids upon it 119 feet over the floor of the church. The main portal is 24 feet high, and 13 feet, 6 inches wide. The whole church is built of freestone and quarry-stone. A gallery extends quite round the church on the upper part of the side aisles and another around the eaves.

Beneath the choir is a crypt 40 feet long and 35 feet wide, divided

into three parts by six columns 8 feet high. The cube-formed capitals of the columns support strong cross-vaults.

The history of the building of this church is the following. In 627, when Edwin, the Saxon king in Northumberland, was baptized at the instance of his wife Ethelburga, a wooden chapel was erected here, which was replaced in the year 642 by a stone church dedicated to the apostle Paul, but this was destroyed by Benda, the king of the Mercians. In 741 the bishop Alcuin built a new church upon this site and the building was already important. In 1069 it was injured by fire, and, scarcely rebuilt, was again in 1134 once more destroyed in the same manner. Archbishop Thurstan, therefore, built a new church in the Byzantine style, of which the crypt still exists. In the year 1227, the southern transept with a beautiful round window and portico was erected. John le Romayne, treasurer of the church, built the northern belfry and that upon the intersection of the aisles in 1260, and his son of the same name, who was bishop, laid the corner-stone for the main building and the tower façade in 1291. As all these parts were built in the German style Archbishop Thoresby, in 1361, had the choir rebuilt so that the church became symmetrical. The Archdeacon of the church, Walter Skirlan, was the architect of this work, and expended much money upon it. The church was completed in the year 1405. It was much injured by fire several years ago, but it has since been thoroughly repaired.

16. The Collegiate Church at Manchester. In no country of Europe in which buildings of the German style have been erected, has the artificial construction of vaults been carried to such a perfection, or executed with such taste as in England, in which occur almost exclusively the involutions of geometrical figures. The artificial vaults first occur in the last quarter of the 13th century, and they have been made the supports of a new English style. But as they exhibit no characteristic difference from the German style, appearing within the limits and construction of the pointed-arch style as ornaments of the vaults, such a classification cannot be admitted. On the other hand there are also buildings in England where vaults are constructed not according to the geometrical figures, but with ribs laid according to curves, with numerous subordinate ribs which are nothing but decorations. Several such ribs are united in one knot and recurve, being ornamented either with a hanging keystone or a kind of little temple, or human and animal figures. Often, however, these vaults are made so flat that the ribs seem like an imitation of the artistic wood-work with which the English roofed their large halls. The Collegiate church in Manchester is an example of this roofing. It was commenced in 1400. *Pl.* 41, *fig.* 15, represents the interior view. The ceiling of the choir is composed of such almost flat stone arches, while the main building shows the wooden construction unchanged. This building exhibits upon the whole a blending of the pointed-arch style with the flat ceiling which is characteristic in many other English churches. This building is also a good example of the English flowing pointed-arch style, even if there are occasional traces of the Tudor and ass's-back arches.

17. Melrose Abbey in Scotland. This building was founded by David I. of Scotland in 1136, and is one of the most imposing monastic ruins and one of the most beautiful specimens of German architecture in Scotland. Walter Scott has introduced it in his romance, "The Monastery." Wonderful are the richness and the harmony of details, in which all the original sharpness remains. *Pl.* 41, *fig.* 17, represents the interior, which is, however, far removed from the original noble simplicity of the German architecture, and in which the columns are certainly too heavy for the elegant detail of the arches.

3. The Period of the Renaissance.

In the beginning of the 15th century many Italian architects recognised the beauty of the monuments of a classical antiquity, forgotten for centuries. For although then, much more than now, the most imposing remains lay under their eyes, yet they were so filled with the spirit of the new style, that not only did the old fail to impress, but there were enough voices to declare that they were the relics of a barbarous art. Nevertheless the sentiment of genuine beauty gradually prevailed, and the necessity was experienced of cultivating acquaintance by sufficient attention, with the ancient Roman buildings, and especially of studying the ornaments of a classical antiquity. Thence it came that, inspired by the genius of order and harmony, Giovanni da Pisa placed regular pilasters upon the Campo Santo; that the younger Masaccio introduced three regular orders of columns, one over the other, upon the belfry of Santa Chiara in Naples; and that Orgagna, in the Loggia Lanzi; Alberti, Michelozzi Majano, and Brunelleschi in Florence, Mantua, Venice, and Rome, for the façades of churches and palaces, chose cornices for doors and windows, which were conceived from the remains of old Roman buildings, and introduced colonnades in the regular orders. Yet occasionally a blending of the German style with the antique is perceptible, and although the impression is not agreeable, yet it is easy to recognise in it the struggle for a timely and gradual progress, which, however, is here nothing but a return to the true beauty which the ancient architects had already seen and honored.

Whilst in Germany and the Netherlands the domestic style, that of the pointed-arch, still reigned supreme, and, so far as concerns monumental architecture, was exclusively employed, in Italy and France the influence of the first-mentioned studies began to be felt; and this beam of the beautiful era of art is known as "*the Renaissance*" or revival of old art, which disappeared again only too soon, and left the field to a poor, overloaded, and grotesque style. We will now consider a few of the buildings of the Renaissance.

Beginning with Italy, where the effects of the regeneration were first felt, we will glance at the principal cities in which monuments from that period remain.

1. Venice. The church of St. Zacharias, of which *pl.* 42, *fig.* 1, gives the view, and *pl.* 43, *fig.* 17, the ground plan, is, as a work of the Renaissance,

and both in respect to the construction and decoration, one of the most remarkable buildings of Venice. Its architecture is rather peculiar than beautiful, but it offers in the general and in detail so many singularities that we have selected it for our plate in preference to many contemporary buildings.

The ground plan of this church is simple, and finely illustrative of the type which the church buildings of this period present. It consists of the main aisle and the side aisles, the choir with its gallery and the chapels in place of the old apsis. One of these chapels is wanting, and in its place is the entrance to the side aisle of the church. The main nave has double the breadth of the side aisles, from which it is separated by three arches on either side. The arches rest upon very peculiarly formed columns with very high pedestals, short shafts, and Corinthian or Composite capitals. The two first vaults of the main aisle are cross-vaults; the third, next the high choir, passes into a dome. The girt arches have little or no projection from the vault cappings. The third vault takes the place of the transept. The end of the choir forms half a decagon (in the German churches it is generally a semi-octagon), and departs materially in that from the form of the old Basilicas, whose apsis was round. This circular form appears in the interior, and beautiful mosaics are here introduced as well as in the vaults of the choir. This whole arrangement, viewed from the entrance, offers a very effective aspect, and it is impossible not to wonder at the skill with which the regularity of the Romanesque style is united with the charming grace of the pointed-arch style, for there are everywhere pointed arches, although the coupled windows are in the Romanesque style. The church has only few and unimportant sculptures.

If we turn to the façade of this church, it may serve as a type of the manifold changes which the church style of building experienced during the Renaissance. It must be conceded that the whole arrangement of the façade has something unusual, even ungainly, which is rare in buildings of this period, and it would be difficult in this arrangement to recognise Palladio. But yet, by its great magnificence and the effect of various kinds of marble, as by the skilful distribution of the sculptures, it makes a charming impression. The sculptures of the columns and pilasters, and the cornices which are carried across the latter, produce an effect similar to that of the buttresses of the immediately preceding period; while the straight entablature divided into architrave, frieze, and cornice, as well as the arrangement of the columns and pilasters in tiers above each other, recall again the Roman architecture. Least pardonable are the little columns with which the round gable is adorned, for as the projection and height of the entablature necessary to the effect of the whole are almost equal to half the height of its columns, they appear as an inappropriate ornament, not as an essential part of the façade itself.

The Venetian architect Martino Lombardo, in the years 1450–57, renewed the church which was originally built in 870–80, just after it had been injured by fire. The dome is brick below and wood above.

The Church of the Redeemer upon the Giudecca, of which *pl.* 43, *fig.* 1, shows the exterior view, *fig.* 3, the ground plan, and *fig.* 2, the longitudi-

nal section, was commenced by Palladio in the year 1576. It consists of a nave 92 feet long and 36 feet broad, flanked by very richly decorated chapels. Its transept or the cross-arms terminate in semicircular niches or apsides. The three-quarter columns upon the façade and the Roman capitals are of burnt clay. Next the dome stand two small pyramidal towers. The walls supporting this dome are only 4 feet 6 inches thick. The half columns in the interior of the church have beautiful Corinthian capitals after those of the Pantheon at Rome. Altogether the general impression of the church recalls that of the Pantheon. The arrangement of the three gables above and behind each other can hardly be counted a beauty, especially as the great attic weakens the effect of the principal gable. The placing of the gables behind each other, as in the Pantheon at Rome, was there a necessity because the portico was added to a portal already completed. But in the design of a new façade that should have been avoided, especially when the gables must all lie nearly in the same plane, and cannot be placed at greater distances one behind another.

The Library upon the Piazzetta is another notable building illustrative of this period of Venice. The library was formerly kept there, but it is now devoted to the residence of the viceroy and is called Palazzo Regio. *Pl.* 42, *fig.* 15, is the view of one side of it, *fig.* 16 represents the upper order of columns and the entablature, and *figs.* 17 and 18 are two of the statues which adorn the attic of the building. The façade represented is the one towards St. Mark's Place. The palace itself was built in 1536 from a drawing of Sansovino's, and completed by Scamozzi. The lower story is elevated three steps above the Piazzetta. The front is formed by 21 arches resting upon Doric half columns standing against pillars. On the sides there are three arches. The main story has Ionic half columns, and the windows on the sides fluted Ionic columns. At the side of every arch victories are carved in relief, and upon the ground story masculine allegorical figures. The key-stones of the arches are well executed masks. The frieze is disproportionately high and heavy, and has oval windows. The vaulted ceiling of the former library hall is painted finely in fresco by several masters.

In the church of St. John and St. Paul in Venice is the monument of the Doge Andreas Vendramini, who, after a short and not famous reign, died in 1478, and we mention it here because in few contemporary monuments is the effort to reach the antique so clear and striking as in this. *Pl.* 43, *fig.* 18, gives the general view, and *fig.* 19 the ground plan in half the size of the view. The monument has a double substructure. The cube of the first is richly adorned with arabesques, while the second appears to be the pedestal proper of the columns resting upon it, and contains the epitaph. The Corinthian columns, with attic bases, are 10 diameters in height, and stand one diameter from the wall. The four Corinthian pilasters are adorned upon the shafts with ornamented panels, and inclose two niches upon the sides, in which stand two very profane images, apparently of Bacchus and Venus, represented as Adam and Eve. Near this stands a pair of statues upon pedestals representing Roman generals. The middle niche contains the sarcophagus of the Doge ornamented with eagles, near

which stand three statues with torches. The pedestal of the Sarcophagus is adorned in front and on the sides by seven statues which are intended for the Virtues, but look like Muses. Over the entablature which rests upon the Corinthian columns a high attic rises with a semicircular niche, in which St. John is represented leading the Doge to the Madonna and the child. At the side stands another Roman general or marshal, perhaps intended for St. Paul before his conversion. Upon both sides of the semicircular niche are reliefs which represent a kneeling angel and a praying female figure. How the crown of the whole is to be reconciled with the rest it is difficult to say. This crown represents two angels, terminating below like two sea-horses. They hold a wreath in which stands a boy with an apple. Over the crown is an urn, from which rises a flame. However beautiful the design and execution of this monument may be, it lacks the seriousness and above all the spiritual sentiment of a sepulchral monument.

2. Pavia. A highly remarkable building, which if not designed and begun in this period, yet then received its magnificent façade, is the church near the charter-house in Pavia. Giovanni Galeazzo, who had poisoned his uncle, and was made duke by the German Emperor in 1395, doubtless hoped to atone for his crime by building this church near the charter-house, which had been built in 1376 under Galeazzo Visconti. Enrico of Gamondia (Henry of Gemünd, of whom we have already spoken) made the plan, and the work was commenced in 1396, but the façade was arranged by the painter and architect Ambrogio Fossano in 1473; but unhappily overloaded with ornament it does not correspond to the large style of the interior. *Pl.* 42, *fig.* 6, represents the view of this church; *figs.* 7 and 8, Corinthian capitals of pilasters; *figs.* 9 and 10, niches in which these capitals occur, and in them statues of the Apostle Paul and of St. Veronica; *figs.* 11–14 *a*, consoles for statues; and *fig.* 14 *b*, a medallion with a portrait of Galeazzo. The church forms a Latin cross, occupies an area of 25,370 square feet (consequently $\frac{1}{8}$ of the space of St. Peter's), has three aisles, and many chapels. The width of the main aisle between the clustered columns, which are $7\frac{3}{4}$ feet thick, is 26 feet. The side aisles are 10 feet between the pillars and the wall, and the side chapels are of the same depth. The main nave is 69 feet high, and to the key-stone of the dome over the intersection of the aisles is 107 feet. The main girt arches are pointed, but the side arches round. The arches of the vault over the choir are painted in ultramarine and have golden stars. The remaining vaults are also painted. The walls of the church are of brick, but the façade is ashlered with marble. Upon the buttresses of the side walls are little perforated towers. The choir terminates in an apsis upon which stands a colonnade gallery, whilst at the sides are two strong square buttresses adorned with little towers, and similar ones stand at the apsides and in the corners of the transept. Before the side walls of the main building are vaulted arcades resting upon little columns behind the towers, and forming a gallery, and a similar arcade runs around the church under the roof, appearing even upon the front façade. The various galleries one above another, the pyramidal reduction of the dome, the red natural color of the

brick wall and ornaments, contrasting with the yellow tone of the marble façade, produce a fine effect. The façade formerly had points, which have been removed. It is very rich in sculptures, containing 44 statues, 60 medallions, and many bas-reliefs.

3. Perugia. In Perugia there are important buildings of every period of architecture, from the Roman arch down to the corrupt Italian style, and even the German style may there be met with in all its purity. Of the time of the Renaissance we shall mention the church of St. Francis, built from a design of Michelozzi. *Pl.* 43, *fig.* 4, represents the façade of this church; *figs.* 5, 6, 7, give the capitals of the pilasters in the statue-niches of the portal; *fig.* 8, a detail from the consoles which support the four great statue-niches upon the façade; *fig.* 9, one of the medallions under the lower statue-niches; *figs.* 10–12, ornamental panels; *fig.* 13 represents the foot and crown-cornice of the socle of the façade; *fig.* 14, a console of the lower niches; and *figs.* 15 and 16, two of the patterns of the marble pavement in the interior of the church. The inside of the church is ornamented with beautiful paintings, and its fine architecture makes an agreeable impression upon the spectator.

4. Naples. Among the many superb buildings in Naples, of which we will only mention the Cathedral of St. Januarius, no one more clearly indicates the character of the period which we are now considering, than the triumphal arch erected to king Alfonso IV. of Arragon (Alfonso I. in Naples) upon his triumphal entry in 1445 into Castel Nuovo, and whose façade is represented in *pl.* 42, *fig.* 20. *Pl.* 43, *fig.* 23, is the capital, of the lower Corinthian order, drawn on a larger scale. A part of this façade is the work of Pietro di Martino, a Milanese architect and sculptor (d. 1470), who was rewarded by being knighted by king Alfonso himself. The building, entirely of marble, is rich in ornaments, statues, and bas-reliefs. The most remarkable of the last, in the attic over the entrance-arch, represents the triumphal procession of the king; and the arrangement of this procession, in combination with the niches over the entablature, is remarkable The three statues which crown the summit are those of St. Michael, St. Antonio Abbate, and St. Sebastian. They are supplementary, placed here under the government of the viceroy Don Pietro di Toledo, and are works of the Neapolitan sculptor, Giovanni Merlano da Nola. This triumphal arch is so much the more remarkable, as it is the only structure of this kind that remains to us from that period.

From Italy reawakening art soon found its way to France, especially as King Francis I. not only brought the choicest works from Italy to France, but assembled the most illustrious Italian artists at his court, employing them abundantly, and heaping gold and honor upon them. Hence there are many fine monuments in France which belong to this period, and which we shall consider in the order of the principal cities.

1. Paris. Among the distinguished persons who in the 16th century generously furthered art, the Cardinal George d'Amboise, archbishop of Rouen, and Minister of Louis XII., occupies an eminent place. He built,

among other things, the palace of Gaillon upon the Seine, one of the most beautiful buildings of this period. In the 12th century there was already a country seat upon the site, but it was destroyed in the 13th by the troops of the Duke of Bedford. In the year 1505 the new building was commenced, but only completed in the middle of the century ; and although no expense was regarded in its construction, Colbert afterwards knew how to lavish millions more upon it. In the Revolution it was again destroyed. Alexander Lenoir succeeded in saving a part of the façade. He had it taken off with the greatest care and brought to Paris piece by piece, when he had it again erected in the court of the old convent of the Petits Augustins, of which he had made a museum of antiquities. The building is now the Ecole des Beaux Arts, and the façade stands in the same place. *Pl.* 42, *fig.* 19, gives a view of it. Formerly Jean Joconde was supposed to have been the architect, but it is now properly credited to William Penault and Collin Byard.

In the royal sepulchre of St. Denis, of which we have already spoken (page 168), the monument of king Louis XII. and his wife Anna of Bretagne was distinguished among the other magnificent monuments. *Pl.* 43, *fig.* 20, gives the side view; *fig.* 21, the east; and *fig.* 22, the west side of it. This monument was made at Tours in 1518 by Jean Juste, the sculptor of king Francis I., and then brought to St. Denis. The statues of the apostles and of the cardinal virtues were, however, added afterwards by Paul Pontius Trebatti. The work is of white Italian marble, and represents upon a substructure of black marble, a kind of canopy upon pillars, under which the bodies of the king and queen lie upon a cup-shaped sarcophagus as naked corpses, while upon the platform both appear in full attire kneeling in prayer. The substructure has plates of white marble, with bas-reliefs, which represent the Italian campaign of Louis XII., the battle of Agnadel, and the entry into Genoa. The arabesques that ornament the pilasters are in general poor, although overloaded with motivos of all kinds, which are ludicrously confused. Against the pilasters stand the imposts which support the semicircular arches, whose key-stones are richly adorned, and in whose corners are figures of Genii of Glory. The capitals are carefully, and some even tastefully, ornamented. The ornaments upon the corners suggest the volutes of the Composite capitals. The frieze of the Corinthian entablature contains the epitaph. There are 20 statues upon the monument, including: 1. The two portrait-statues of the king and queen. 2. The same as they lie in the tomb, the head bent slightly backwards and resting upon a handkerchief, the hands crossed. The artist has here represented death in its most ghastly form, for the worms appear in the incisions made for embalming. 3. On the four corners stood formerly the four cardinal virtues, Valor, Justice, Temperance, and Wisdom. These statues are now removed, and stand at the entrance of the choir. 4. The twelve apostles. The last sixteen figures are heavy and mannered, and badly designed. The heads are wanting in nobility, with one exception; and while John has a frightfully long neck, Philip looks remarkably vulgar, so that these figures together are very ludicrous. They are the work of Paul Pontius Trebatti.

2. Vetheuil. The church of Notre Dame in Vetheuil (the old Vethelium near Mantes) is of three epochs. The choir was built by Henry II. of England. The tower is of the 14th century, built by command of Joanna of Evreaux, the third wife of Charles the Fair. The vestry, the western portal, and the transept, date from the time of Francis I. The western portal, of which *plate* 42, *fig.* 2, gives a view, and whose ground plan is represented in *fig.* 4, has on both sides a pair of wing walls, which excepting a pierced baluster, are devoid of decoration, and are even without windows. It projects somewhat, has a pair of stair-towers on the sides, and is divided into three stories. The lower story is the highest, and is almost as high as the wing walls. It has a door, divided by a central pillar into two gates, with low vaulted ceilings. Before the pillar stands upon a column whose base and capital are given in *fig.* 3 *a* and 3 *b* the statue of Christian Love under a canopy; over the gates are semicircular niches. The projection of the tower is also ornamented with niches, whose canopies instead of ending in pyramidal points bear a kind of dome in the style of the Renaissance. The lower story is divided by a Doric entablature with triglyphs and modillions, over which is a low gable with an unrecognisable bas-relief. There are no statues in the niches. The second story has two somewhat projecting wings with corner columns upon a small plinth connected by a railing over the above-mentioned gable. The middle part has two rather narrow windows upon whose sides are two medallions with sculptures. The windows are semicircularly closed, and have also medallions with heads which the Renaissance introduced in abundance, a style which is now again pursued with great earnestness. From the imposts of the window arches rise little Ionic pilasters, which support the cornice which extends over the projecting wings, and is ornamented with Jacob's shells. The third story is almost entirely like the second, but is still simpler. The projecting wings support small octagonal towers with corner columns, and with tile-covered domes which have a peculiarly formed point. The three-cornered projections at the bottom of these towers are decorated with vases. The crowning of the middle part forms a fronton in the shape of a true arc, upon which, in a very remarkable manner, balls are introduced as ornaments, which much disfigure it. The fronton is surrounded by a cross. *Pl.* 42, *fig.* 5, shows the ground plan of the southern portal. It is peculiar, as it forms a hall receding into the church.

III. MODERN ARCHITECTURE.

In our examination of the architecture of antiquity and of the middle ages, we have based our divisions partly on the manner of single races, and partly upon peculiar styles, because as the original architecture of a people is determined by their manner of life, by their character, by the land they inhabit, and its climate, and takes from all these influences its peculiar character, which must remain for a long time unchanged, owing to the

limited intercourse among different people of old, we could speak very distinctively, *e. g.* of an Egyptian and a Grecian architecture, without danger of meeting the same or even similar characteristics in both. This is some what true also of the middle ages. Nations were much more separated then than now, and peculiar styles were formed with very distinguishable characteristics. Religion and increasing trade, however, united the European nations more closely. The fact that in the middle ages the monks were mostly the architects of their own churches, led to the introduction of the different styles from one part of Europe to another. Hence we see buildings of the same style in very different places. Yet the original type of the style was generally closely followed, and if we occasionally find a mixture of styles in churches and other large buildings, it originates as we have already observed from the long duration of their construction extending through the periods when important changes in taste or manner influenced the several architects, who in succession had charge of the progressing edifices.

In the architectural history of modern times, however, the relations of things are different. After the beneficial influence of refinement in architecture had lasted for some time after the Renaissance, attention was exclusively directed to the old monuments of ancient architecture, and the imitation of these was attempted. But while such men as Michael Angelo and Raphael and their contemporaries wisely recommended the study of the noblest ancient monuments as a means of improvement of the public taste, persons of an ill-advised zeal devoted themselves blindly to the study of the relics of that period of antiquity when architecture was already declining, and when excessive ornaments rather than noble forms were resorted to for effect, such as broken gables over doors and windows, and similar absurdities which had no architectonic truth or necessity whatever. Hence arose the new, and from that the *corrupt Italian* style. But as Italy was the traditional land of art, these defects were all carefully copied everywhere, and the corrupt style spread, receiving occasional additions, especially in France, which tended to make it if possible still more abominable. From this period date those architectural monstrosities which are found in all parts of Europe, and enjoy the little flattering epithet of the *queue style.* It was reserved for the most recent times to supplant this awkward taste. Greater knowledge of Grecian and other remains, and zealous study of them, led to the rejection of all fantastic and superfluous ornaments; graceless forms disappeared, and a closer investigation of technicalities and manners of construction did away with much of the former clumsiness. But with this disappeared the nationality of style, and all forms were adopted promiscuously, modified according to the special purposes of edifices. Hence many modern cities contain specimens of the styles of architecture of almost all people and all times. In considering modern buildings, we can therefore no longer follow our old divisions of styles, for no style is consistently employed in any place. We have preferred to classify them according to their different purposes, and describe the edifices of the same class in ethnographical order. The reader will thus be able to form an idea of the

architectural taste and progress of the several nations. We have included in the list several buildings which according to their plans belong to an earlier period, but were finished, rebuilt, or decorated in the present; for instance such churches as Santa Maria del Fiore in Florence.

1. Churches and Chapels.

A. Italy.

The number of churches built in Italy during the last three centuries is astonishing, and an adequate description of them would fill volumes. We have, therefore, selected some of them as representatives of the changes and progress of the art in Italy, and will describe them in chronological order.

1. Santa Maria del Fiore in Florence. To the largest buildings of the new Greek style belongs this church, or the cathedral of Florence, which was commenced in 1298 upon the site where the old church Santa Reparata had stood. Although some regard Arnolfo di Cambio de Cola as the architect, yet Vasari has proved that Arnolfo da Lapo, a German, made the design of the church, of which *pl.* 49, *fig.* 6, gives the ground plan, and *pl.* 45, *fig.* 6, the rear view. The ground plan forms a Latin cross, and consists of a middle aisle, two low side aisles, the choir under the dome, and the transept which intersects the choir. After Arnolfo's death the work advanced slowly and under the following architects: Giotto da Vespignano, Taddeo Gaddi, Andrea Orsagna, Filippo di Lorenzo, Brunelleschi, who added the no less artistic than beautiful dome, and finally Baccio di Agnolo, from 1547–74, who completed it. Arnolfo da Lapo had neither left sufficient drawings for the dome nor for the centring; consequently in the beginning of the 15th century, when it was necessary to vault the domes, no one knew how to do it. Brunelleschi made sketches for the work, but was unheeded until in 1420 he was elected architect. He completed this gigantic work in 14 years (1434) and began also in 1437 the lantern, which was not completed until 1456, twelve years after his death.

The middle aisle is 50 feet broad between the pillars, and the side aisles 27 feet. The pillars are 8 feet thick; the side walls the same thickness. The whole length of the church is 448 feet, and the middle aisle is 129 feet high. The height of the pillars to the commencement of the connecting arches is 46 feet, to the commencement of the cross-vault 91 feet, to the vertex of the connecting arches 79 feet. The pillars and vaults are of hard grey sandstone. The exterior is faced with white, black, and green marble in panels, and around the roof of the dome runs a very beautiful marble gallery. The octagonal cupola is raised over the middle of the cross 264 feet above the church floor. Its own height is 99 feet, 6 inches, and its diameter is 139 feet. The summit of the cross upon the lantern is 361 feet above the floor. The area occupied by the building is 83,988 square feet, and is to that of St. Peter's as 1 : 2.31. The whole cathedral and the cupola are accessible by stairs, and in two main pillars there are vestries. The floor is

paved with colored marble after designs by San Gallo, Michael Angelo, and Baccio d' Agnolo. The western façade was formerly in the Byzantine style and ornamented with twenty-four statues; but Benedetto Ugaccioni, the overseer of the church, had the madness, in 1586, to employ the lower classes during the famine in tearing it down. Later a new façade was commenced by Salvani, but it was so bad that what was finished was taken down, and finally a tasteless painted front in the corrupt Italian style was introduced, which still exists, bearing witness to the disgrace of the time and disfiguring the beautiful church.

2. San Andrea in Mantua. This church was designed by Leo Battista Alberti, born in Florence in the year 1398, whose best work is the palace Rucellai in Florence, and its erection commenced in the year of his death, 1572. It is not yet entirely completed. *Pl.* 50, *fig.* 9, shows its ground plan. It forms a Latin cross and has a dome over the intersection of the nave and transept. In the main building, which is covered with a casetted cylindrical vault, the pilasters which support the cornice are apparently coupled, so that instead of side aisles, larger and smaller side chapels are formed. The choir-termination is formed by two intersecting semicircles. There is a crypt added in modern times by the architect Salucci, and whose flat vaults rest upon 8 columns. The present, but still unfinished, façade is by Juvara. It lacks yet the vestibule and one tower, only one being completed.

3. The Clock Tower in Venice. The place of St. Mark in Venice is surrounded, as are few places in the world, with a great number of beautiful and time-hallowed buildings, almost all of historical interest. To these belongs the clock tower (*Torre del orologio*), which stands in immediate contact with the palace of the procurators. The middle part, which was built in 1496 by Pietro Lombardo, is 92 feet high; the wings were added in 1500 by Carlo Rainaldi of Reggio, and are 75 feet high. In the third story is the great clock of Venice, the lower story is occupied by stores, and the rest of the building by dwellings. In the lower story the façade consists of a large arch and several pilasters, next which stand little Corinthian columns upon high pedestals.

4. The Bell Tower of Palermo is of a similar plan, but smaller. It was built almost at the same time. *Pl.* 48, *fig.* 12, gives the view. The middle part, with many openings, gives the otherwise well designed façade a certain heaviness; and the singularly formed dome, with its far projecting balusters unpleasantly dividing it, makes a peculiar impression.

5. The Bell Tower in Rome, near the Basilica St. Maria in Cosmedino, was built in the 12th century, upon the remains of a temple of Ceres and Proserpine. *Pl.* 53, *fig.* 12, gives the view, *fig.* 13 the section, of this tower. It is about 120 feet high and only 15 feet square. The lower part, about 32 feet high, is without opening, and there are two Corinthian columns within its walls from the old temple of Ceres (*fig.* 13). This substructure supports 7 stories, the two lowest of which have 2 and the upper 3 arched windows. The three lowest stories have pillars of brick-work, the upper little columns of marble, with handsome marble capitals. The exterior is

inlaid in several places with plates of porphyry, and the cornices, which separate the stories, have modillions of white marble.

6. The Church San Pietro in Montorio in Rome. In the year when Brunelleschi died (1444), one of the greatest architects of his time, Bramante Lazzari, was born in Castello Durante, near Urbino. He studied with great zeal the architecture of the old monuments, and his buildings, which are many, although he began late, show the fruits of these studies. One of his most beautiful works is the church San Pietro in Montorio in Rome, one of the smallest but finest of architectural achievements. *Pl.* 45, *fig.* 7, gives the ground plan, *fig.* 8 the front view, and *fig.* 9 the section of this church, which occupies the centre of the cloister of the convent of San Pietro, in Montorio, and under which there is yet a round chapel dedicated to the apostle. Bramante built this church in the year 1502, and it was the first sacred building departing from the old Basilica type ever erected in Rome. Sixteen beautiful Doric columns form the peristyle, each of a single granite block. The attic appears perhaps a little too high, but the whole makes a fine impression.

The principal church of San Pietro in Montorio is not to be confounded with this smaller one. The larger one stands upon the Janiculine hill in Rome, and to it belongs the cloister in which Bramante's church was built. It is a very old church and consists of an aisle with a choir apsis and side chapels, and is roofed over in part with two cross-vaults. This church received a new façade in 1475, designed by Baccio Pintetti. *Pl.* 46, *fig.* 12, represents it. It has a door with a straight lintel, 6 feet 3 inches broad and 12 feet high.

7. The Church della Consolazione in Todi. In 1505, a few years after the commencement of the above mentioned church, Bramante began the church della Consolazione before the walls of the little city of Todi, in the Duchy of Spoleto. *Pl.* 50, *fig.* 6, shows the front view, and *fig.* 7, the section of this church, whose ground plan forms a square, upon each side of which a semicircle is attached, forming a Greek cross. Each one of these semicircles is covered with a half dome, and over the middle of the centre space is a drum, over which stands the chief dome. The art with which the architect has adapted the height of the various colonnades to each other, and the harmony of all the lines, as well within as on the exterior of the church, deserve attention.

8. St. Peter's in Rome. The work which immortalizes the name of Bramante is St. Peter's church in Rome; and although he did not complete it, and even his design was not entirely followed, yet it was he who first advanced the bold idea *of setting the pantheon upon a basilica*, and thus accomplishing a work unapproached in grandeur. St. Peter's church, of which *pl.* 44, *fig.* 1, gives the entire ground plan, *fig.* 2 the horizontal section of the three domes, *fig.* 4 the geometrical side view of the church proper, and *fig.* 3 the perspective view of the whole edifice, is remarkable in respect to the sums lavished upon it and the means adopted for raising those sums, which was the famous selling of indulgences. Perhaps without the selling of indulgences Luther would never have been compelled to protest publicly,

and the reformation might have been retarded if Bramante's simple plan had been adopted which he had sketched for a church upon the site of the old basilica, San Pietro, as his design did not require the immense sums that were afterwards expended in the erection of modern St. Peter's.

Pope Nicholas V. was the first who thought of building a new church (when the old one was considered decaying), and he caused Rosellini to draw a design, which was not followed and was lost. Seven popes after Nicholas permitted the matter to rest, until Julius II. revived it. Among many plans that of Bramante was selected. According to him the church was to consist of three aisles in the form of a Latin cross, with three entrances to them, under a portico of 36 columns, unhappily at unequal distances. The pillars of the interior were to have had niches, and the four chief pillars to have supported a dome of 127 feet in width and 67 feet in height from the drum, which was to have been a circular wall 32 feet high and 12 feet thick, surrounded by 48 disengaged Corinthian columns 3 feet thick. The dome, finally, was to have been surmounted by a lantern 94 feet high.

On the 18th of April, 1506, the corner-stone of one of the chief pillars was laid by the pope, after the old basilica had been removed in injudicious hurry, and only a single one of its exquisite mosaics, that still exists in the present church, had been saved. Bramante, who must have foreseen an alteration of his plan after his death, aimed at having at least the dome retained, and so only the main pillars were constructed. But in spite of the great zeal with which he pursued the work, they were only completed to the main cornice with their arches at the time of his death in 1514. When Leo X. ascended the papal throne, Giuliano di San Gallo, Fra Giocondo of Venice, and Raphael of Urbino, Bramante's nephew, who had his drawings, were named as commissioners of the building. San Gallo soon returned to Venice, Fra Giocondo died, and Raphael continued the work alone, strengthened the foundations and the pillars themselves which had proved too weak, but died in 1520. After him Balthasar Peruzzi was architect, and made a new plan by which the church would have formed a Greek cross, but would have become of inferior effect. Around the great dome four smaller ones were to have been placed; the three great apsides which Bramante had already arranged, and which still remain, Peruzzi retained. This poor plan was only commenced, however, when Pope Paul III. appointed Antonio San Gallo, the nephew of Giuliano, as the assistant of Peruzzi, and he soon after the death of Peruzzi presented his own plan in a model made by Labacco, in which the form of the Latin cross was restored. This plan was rejected, and San Gallo died of vexation in 1546. Thus the work had advanced for forty years without any plan, when Michael Angelo Buonarotti drew a new design, and Paul III., who had called him to Rome, appointed him sole architect. Michael Angelo approached again the form of the Greek cross, and according to his plan the church was built as far as where in our ground plan (*fig.* 1) stands the first row of pillars in the main building, so that the ground plan was a square, with a fore-hall and three semicircles attached. Here, at the great

division, the building was to end, and a double portico of 10 and 4 columns was added. This plan was accepted as unalterable by an apostolic brief. Lorenzetto served as superintendent under Michael Angelo, who conducted the work for seventeen years without remuneration. In the year 1557 Michael Angelo had completed the great vaults under the drum which was to bear the dome, and made the model of the dome, but this was not begun until twenty-four years after his death, which occurred the 15th February, 1564. Pirro Ligorio succeeded Michael Angelo, but he did little, and Vignolo followed, with strict orders not to deviate a hair's breadth from the plans of Michael Angelo. By him are the two side domes (*fig.* 3), and he faced the exterior wall with ashlers. After Vignola's death in 1573, Gregory XIII. intrusted the work to Giacomo della Porta, who completed the building to the above-mentioned limits of Michael Angelo's plan, after which only the dome, but that the most difficult part of all, remained to be executed. Sixtus V. now named the Chevalier Domenico Fontana as architect, whose son Carlo Fontana designed the centring. It consisted of eight suspension pieces uniting in the centre, and of beams jointed one above the other, over which the sixteen chief ribs of the vault were to be constructed simultaneously, all being kept at equal heights. On the 15th July, 1588, the work commenced with 600 laborers working in turns day and night, under the superintendence of Domenico Fontana, and twenty-two months later, on the 14th March, 1590, the pope himself laid the last consecrated stone in this vault.

Meanwhile some fissures showed themselves in the vault of the dome, and its fall was feared. But Carlo Fontana showed the baselessness of such fears, and a great counsel of architects and mathematicians that was summoned in 1742 on the strength of similar apprehensions, decided that there was no reason to fear a fall, yet by Poleni's advice it was concluded for greater safety to place five girdles around the dome. This was accomplished in 1747 by Vanvitelli, and since then no new precautions for security have been necessary. To return to the earlier history, the crypt under the middle of the church, to which access is had from the interior, was enlarged by Domenico Fontana, who also introduced additional light.

As Michael Angelo's plan ended at the point indicated above, and as it was feared that the interior might be too small for the immense throng that would assemble for the Year of Jubilee and the coronation of the Pope, Paul V. resolved to enlarge it. Maderno accomplished this by designing the remainder of the edifice including the portal of travertine. The five doors leading into the church are covered with bronze plates with costly bas-reliefs. The middle one, with representations from the lives of the apostles Peter and Paul, was cast in 1430 by Antonio Filareto for the old church. The fifth door is walled up and is called the holy, because it is only opened once every year of jubilee.

Until the year 1660 the church had no adequate avenue, and among many new and old plans Pope Alexander VII. chose the colonnade of Bernini shown in our ground plan (*fig.* 1). In order to complete it, it was necessary to remove many buildings, and among them the house of Raphael,

built by Bramante. On the 25th August, 1660, the corner-stone of these colonnades was laid, which are 1056 feet long and in the long axis of the ellipse 738 feet wide. The inner colonnades of the elliptical hall stand 524 feet apart, and the colonnade wings consist of four rows of Doric columns, 41 feet in height, numbering 256, which support an entablature without triglyphs (see page 100), 9 feet, 6 inches high, surmounted by a balustrade 6 feet high, adorned with 96 statues, 9 feet, 6 inches high. The diameters of the four rows of columns, beginning with the innermost, are respectively 5 feet 3 inches, 5 feet 6 inches, 6 feet, and 6 feet 3 inches, so that the rules of perspective and optics are regarded. In the middle of the place inclosed by the wings stands an obelisk 124 feet high, erected in 1556, and at some distance towards both sides are two great fountains. The flight of steps before the church (*Scala regia*) is the largest in the world, for the outermost steps are 620 feet long. It will be found interesting to consider more particularly the dimensions of this temple, which is paved with marble of various colors.

Its length (*fig.* 1) is 657 feet, 4 inches. The length in the clear of the middle aisle is 565 feet, 6 inches; that of the transept 415 feet. The width of the middle aisle is 78 feet; that of the cross-arms 73 feet, 10 inches. The inner width of the dome is 125 feet, the thickness of the principal girths at the lower edge is 4 feet and at the lantern 3 feet, those of the outer cupola are 3 feet thick below and 2 feet above, and the thickness of the four principal pillars in the shorter diagonal is 55 feet, in the larger 78 feet. The smallest thickness of the outer wall is 26 feet. The height of the middle aisle is 144 feet, and the thickness of its principal girths is 3 feet, 6 inches. The four pairs of decorative pilasters are 78 feet high and 8 feet broad. From the pavement to the opening of the lantern is a height of 310 feet, 10 inches, and to the upper part of the cap of the lantern 363 feet, 6 inches. The diameter of the little domes of Vignola is 38 feet, 3 inches, and their height above the drum is 21 feet. Their openings are 192 feet above the floor. The church covers an area of 199,926 square feet, of which 52,218 square feet are occupied by the masonry, which consequently covers more than a third. If five square feet are reckoned to a person, the church and its fore halls can hold almost 29,000 persons. The church has the high altar not towards the east, which is very remarkable, but towards the west. Towers were to have been erected on the façade of the building, and Bernini had improved the plan of Maderno and Fernambosco and the work was begun. They were to have been 164 feet, 6 inches high, but as it appeared that the foundations of the church would not bear them and as the walls began to crack, the completed part was removed in 1647.

9. The Church San Giorgio Maggiore in Venice. We now come to the period of one of the most famous architects of the 16th century, Andrea Palladio of Vicenza (born 1508, died 1580), who gathered his knowledge from the works of Vitruvius and Alberti, and was practically instructed by Trissino. His finest works are in Rome, in Venice, and in his native city. In 1556 Palladio began the church San Giorgio Maggiore upon the island of Giudecca in Venice, of which *pl.* 46, *fig.* 10, gives a view, and its interior was completed in 1579. The first church upon this site had three aisles.

and its old brick bell tower stands yet at the side of the present choir. Palladio gave his plan the form of a Latin cross with a gabled projection consisting of four half columns. The cross-arms are rounded off and a dome rises on the cross. The three-quarter columns of the façade crowned with Roman capitals, are 5 feet thick and 54 feet high, and stand upon high pedestals and are intersected by the cornices of the corner pilasters which are lower. The church is as little an example of a beautiful style as the façade of the church of Trevignano (*pl.* 45, *fig.* 11), which has a similar ground plan but three aisles of equal height, for which reason the façade, from the unimportant character of the front attachment, appears jejune while it crushes the latter by its weight. Much better is the façade of the Church delle Figlie in Venice (*fig.* 10), which, by the two well harmonized arrangements of half-columns and pilasters and the graceful gable over them, has a good effect.

10. The Church of St. Francesco della Vigna in Venice. This church was first erected by Martin da Pisa in the 13th century, and was so ruinous in the 16th century, that in 1534 it was renewed from a design of Sansovino. Palladio changed it somewhat and made the façade (*pl.* 46, *fig.* 11). It consists of large and small Corinthian columns of marble, and has a semicircular window. On the sides of the main-aisle, which is 49 feet 3 inches wide, are chapels with very beautiful bas-reliefs. There is in this church the same impropriety as in the façade of the church San Giorgio Maggiore, yet the mouldings of the high pedestal of the half column are better combined. The intersection of the columns by the cornice of the lower order is, however, not to be justified. Palladio found many imitators in France and England. The church of Mary Magdalen at Bridgenorth, of which *fig.* 7 gives the elevation and *fig.* 6 the ground plan, and the church Notre Dame de Lorette in Paris, a view of which is given in *fig.* 2, and the ground plan in *pl.* 48, *fig.* 6, are entirely modelled upon the best works of Palladio.

11. The Basilica in Vicenza. In his 30th year, after completing the public palace Il Castillo in Udine, and the villa of his master Trissino, Palladio undertook a work of great importance. The magistracy of his native city had requested designs from three architects for the reconstruction of the council house or the so called Basilica, and as Palladio's gained the prize the work was intrusted to him. *Pl.* 45, *fig.* 5, gives a view of this edifice. The old building was to be surrounded upon three sides with colonnades of hard stone. The columns and pilasters are of marble, the walls of brick. The length of the largest side is 395 feet. Of the ten principal pillars, those on the corner had three columns, the middle ones had each one half column of the Doric order. Between them stand four coupled, small Tuscan columns, with an entablature connecting them with the small pilasters of the principal pillars. Over these four columns an arch is sprung reaching almost to the architrave of the Doric order. The story above is of the Ionic order, and disposed in the same way. Over the corner columns stand statues upon pedestals, connected by a railing. Over the eight middle columns is an attic with round windows, over which is a roof constructed of rafters and

covered with lead. Its ribs are 9 to 10 feet apart. The arcades have cross-vaults.

12. The Church Madonna degli Angeli at Rome is a work of Michael Angelo, built of a part of the remains of the Baths of Diocletian (*pl.* 46, *fig.* 19, ground plan, and *fig.* 20, lateral section). Its ground plan is in great part determined by the position of the ruins, for the great hall of the baths forms the chief part of the church. The eight antique granite columns, 43 feet 6 inches high, have Corinthian and Roman capitals, but the fine old door of the hall is walled up. Before this a handsome dome rises over the fore-church, between which and the church proper is a vestibule with four columns. Battista Soria has not much improved the church by his additions. It is roofed with heavy old cross-vaults. Its dimensions are 336 feet length, 308 feet breadth, and 84 feet height. Adjoining the church, also in the ruins of the baths, is the cloister surrounded with one hundred columns, and designed by Michael Angelo.

13. The Church of the Assumption in Genoa. Galeazzo Alessi (born in Perugia in 1500, died in 1572) was for Genoa what Bramante was to Rome, Palladio and Sansovino for Venice, and Ammanato for Florence. He beautified the city in every direction. He built the Church of the Assumption (*pl.* 45, *fig.* 3, plan; *fig.* 4, elevation). This church is by no means one of the largest, but one of the best monuments, and of complete unity in all its proportions. Its ground plan forms a regular square of 150 feet, with a small addition about 20 feet deep for the high choir where the altar stands. The middle of this square is surmounted by a dome of 40 feet diameter, resting upon four massive pillars. The interior of the church forms a Greek cross, so that this church may be regarded as the completion upon a small scale of Michael Angelo's plan of St. Peter's. The exterior of the dome consists of the drum, composed of arches and massive masonry, and adorned with Corinthian pilasters, and of the overtopped dome whose lantern has a semi-spherical cap. The effect of this dome, which is 180 feet high, is in perfect harmony with that of the portal.

14. The Church Santa Maria della Vittoria in Rome. Among the architects who helped to originate the corrupt Italian style which at the end of the 16th century extended from one end of Italy to the other, and overloaded the façades with pilasters, gables, and niches, must be reckoned Giamb. Soria, who built the façade of the church Maria della Vittoria at Rome (*pl.* 50, *fig.* 5, elevation). This church was erected at the expense of Cardinal Scipio Borghese in gratitude for the ancient statue of the Hermaphrodite found in digging the foundations of the church, and presented to him. So fair a gift deserved a fairer recognition than this hideous façade. The church was commenced in 1605 under Paul V., and the interior was ornamented by Maderno with pilasters of Sicilian alabaster, with gilded statues, and paintings of Guercino and Guido Reni. The pavement is marble.

15. The Church of St. Ignatius in Rome. Alessandro Algardi (born 1602, died 1654) was, like his pupil Baratta, both sculptor and architect, and his peculiar gift was the arrangement of irregular places and fountains.

Many buildings of his are extant, but they are all in the corrupt Italian style. Among these is the façade of the church of St. Ignatius in Rome (*pl.* 48, *fig.* 9), whose front projections, double tiers of pilasters one above the other, and poor frontons, make it an example of utter tastelessness. The church was begun in 1626 at the expense of Cardinal Ludovisi, from the design of Father Grassi or of Domenichino, and was completed in 1685. Father Pozzo crowned the work by furnishing the church with singularly tasteless altars. Its length is 140 feet, and it is 103 feet high. In the interior there are coupled fluted Corinthian pilasters standing in front of the pillars of the nave, with a complete entablature, and above that an attic, with tasteless work in stucco.

16. The Church San Carlo alle Quattro Fontane in Rome. Among all the architects of the 17th century, Francesco Borromini (born 1599, died 1667) contributed most largely to the disgrace of architecture. Originally a sculptor, he studied architecture with Maderno. His works are remarkable for showing how far a favored artist can possibly go astray. He hated regularity, and crammed his façades with broken entablatures, pilasters, semi-columns, niches, senseless ornaments, and door and window pediments of every imaginable form. Notwithstanding this, his works were engraved on copper as specimens of beautiful architecture, and so greatly assisted the corruption of art throughout Europe. The above-mentioned church, built by him in 1640 (*pl.* 48, *fig.* 10, ground plan; *fig.* 11, the façade) proves the truth of our assertion. This mixture of straight, convex, and concave lines, of semi-columns above each other, of niches and sculptures, of scroll cornices and reversed consoles, indicates only the taste of an architect who degraded his art to the level of a joiner's craft, and found pleasure in doing precisely the reverse of what others did. The interior of the church is, as the ground plan shows, formed of irregular, crooked lines, and contains 16 Corinthian three-quarter columns, 22 feet high.

17. The Church della Superga in Turin (*pl*. 45, *fig.* 1, plan; *fig.* 2, elevation). One of the best pupils of the architect Carlo Fontana, whose ability we have already observed in St. Peter's, was Filippo Ivara (born 1685, died 1755), of whose beautiful buildings a great number still remain. The most beautiful is doubtless the seminary and church della Superga, upon a height near Turin. From this point a broad view of country is commanded. Here in 1706 Victor Amadeus and Prince Eugene projected the plan of defence for Turin, and Victor Amadeus vowed, should he be victorious, to erect there a splendid temple to God. After the liberation of Piedmont, Ivara began the building in 1715. It was finished in the year 1735. The plan cannot be over-praised. It covers an area of about 500 feet in length and 300 in breadth, and forms a symmetrical quadrangle. The building of the seminary is very skilfully joined to the church. The interior has a court of 150 feet in length, with two tiers of colonnades, and around this dwellings are distributed. The outer plan of the church is united with the common passage by a more than semicircular part, before which stands a portico of columns, four across the front and three in depth. To it are joined two retreating façades, which are adorned with Corinthian

pilasters, and unite on both sides with the convent, while they constitute part of the church façade. Upon each wing is a bell-tower, which skilfully relieves the mass of the dome. Inside, the more than semicircular part changes into a polygon which forms the circumference of the dome, whose support are the pillars of the arcades and the divisions which contain the chapels, ranged all round. The choir and the high altar occupy a prolongation of the space occupied by the church. The whole combination is admirably conceived. The inner height of the dome is 150 feet, the outer 165, and with the lantern 200 feet. Its inner diameter is 56, the exterior 80 feet. It belongs to the first domes of the second rank.

B. France.

In France the same general proportions were observed as in Italy, for France has always followed the Italian school in the fine arts, and has done very little of itself. But it has very skilfully adopted and developed the styles of its neighbors.

1. The Church of Sts. Gervais and Protais in Paris. This church claims notice here solely on account of its façade (*pl.* 46, *fig.* 3), for the building itself was founded in 558, and renewed in the German style in 1212, probably by Montereaux. When it was again repaired in 1581, the hanging keystones of the vaults were added, for such a construction was not usual in the 13th century, but was introduced later in England. The middle aisle is 24 feet broad and 80 feet high, and is remarkable for having galleries, which were of rare occurrence in the middle ages. The façade represented by us was added in 1616 by Jacques de Brosse, and completed in 1621. It is 82 feet broad and 132 feet high. Beneath it is finished with four disengaged and four half columns of the Doric order, and a heavy attic over the entablature of this order, above which are eight fluted half columns of the Ionic order, with niches between them, and the window divided by a centre column. Over this again there is a heavy attic, above which is the upper building, with four Corinthian half columns, an entablature, and a gable, whose outline is an arc. *Pl.* 46, *fig.* 4, gives the ground plan of the portal; *fig.* 4*a* and *fig.* 4*b*, the Doric; and *figs.* 4*c* and *d*, the Ionic order. In the last, the convex frieze over the low architrave has a bad effect.

2. The Church of St. Paul and St. Louis in Paris. Formerly the Jesuits had only an establishment for the reception of novices in Paris; but the Cardinal de Bourbon, uncle of Henry IV., gave them ground for the erection of a church, of which Louis XIII. laid the corner-stone on the 10th March, 1627. The Jesuit François Derrand designed the plan and directed the building. *Pl.* 46, *fig.* 5, is the façade of this church, which was begun at the expense of Cardinal Richelieu in 1634, and finished in 1641. The façade, the most important part of the church, consists of three orders, above each other. The two lower are Corinthian and the upper one is Roman. The arms of Richelieu were formerly displayed upon a round gable over the main door. He consecrated the church and said the first mass in it. The middle story has upon its middle space an ornament of elliptical form, that contains the

cypher of the Jesuits in a flood of rays, and on the right and left are niches with the statues of Ignatius Loyola and Francis Xavier. In the upper story, which has only four columns, stands, in a niche, the statue of St. Louis. In former times (and our copy is from Derrand's drawing) the façade was overloaded with ornaments, which are now removed, and the effect, although not in the best style, is much improved.

3. The Hôtel des Invalides in Paris. One of the most famous French architects next to Mansard was Liberal Bruant, who lived in the 17th and 18th centuries (born in 1640). The Hôtel des Invalides is among his best buildings. Of its church, *pl.* 47, *fig.* 1, gives the ground plan, *fig.* 2 the view, *fig.* 3 the section, *fig.* 4 the ground plan of the dome, and *figs.* 5 and 6 details of the arch soffits, whilst *pl.* 50, *fig.* 1, represents the interior. The façade of the entire building, which consists of five courts, is 615 feet long. In the rear of the middle and largest court which is surrounded by a gallery of double arcades, is the portal of the church, which now contains the ashes of Napoleon. The façade of the Invalide-house itself has arcades below and three stories above. In the middle a large arch crowns the portal. Upon the great court are 4 eating-halls, each 138 feet long, 33 feet wide, and 31 feet high. Louis XIII. founded the building in 1634 according to another plan, but the erection was interrupted, and Louis XIV. had it built from Bruant's plan in 1670. The church designed by that architect is not to be confounded with the later addition, but embraced only the part *a* (*pl.* 47, *fig.* 1), with the two round vestries *c c*. It consists of a fore hall and three aisles of which the middle one is 38 feet, the side ones only 9 feet, 6 inches wide. Upon these side aisles rests the gallery. Outside of the vestibule stand six pairs of Doric and over them as many Corinthian columns, coupled. Between the vestries, *c c*, is the oval division *d*, with the richly decorated altar *b*. The height of the aisles is 85 feet, and over the altar is yet a wooden dome 15 feet high.

Thence you enter the cathedral proper *e*, whose Corinthian columns (4 feet thick and 36 feet high), with the pillars which are finished with Corinthian pilasters, support the drum of the dome which is 73 feet wide inside. The dome itself is of wood, and its highest point is 210 feet from the church floor. The dome begins 68 feet above the gable of the façade. Its form is handsome, and its height to the breadth is as 5 to 3. It is gilded and upon it stands a lantern crowned with a cross, 275 feet above the floor, and surrounded with Corinthian columns. The cathedral was begun by Hardouin Mansard and finished by de Cotte. It occupies an area of 30,132 square feet, and with the old church the whole amounts to 43,896 square feet, and is to St. Peter's as 1 : 4.55. The cathedral is much like the chapel at Fresnes built by Cotte, of which *pl.* 46, *fig.* 13, gives the ground plan, and *fig.* 14 a section. It consists of a fore church and a square that supports the dome, which is accompanied by three half domes over the niches.

4. The Church of the Sorbonne in Paris. Jacques Lemercier, who died poor in 1660 as first architect of the king (a fact of rare occurrence), built a great deal. His most important work was the church and college of the Sorbonne, finished under Richelieu in 1653 (*pl.* 47, *fig.* 9, ground

plan, *fig.* 10, side view, *fig.* 11, lateral section). It forms a rectangle 150 feet long and 72 feet, 6 inches broad. Its dome, 38 feet wide, divides it into 2 equal halves. The middle aisle is 31 feet wide and 51 feet high. The cap of the dome ends at a height of 103 feet from the church floor, with an opening 6 feet wide. It rests upon walls 3 feet, 8 inches thick. Upon this wooden dome stands a lantern 32 feet high. The whole exterior height is 148 feet. Although the church belongs to the corrupt Italian style, it is yet one of the best conceptions of that time, and if the portal, instead of the heavy attic, had a gable, little could be said against the front.

5. The Church of the Assumption in Paris. A building of the better Italian style and among the most beautiful in Paris is the Church of the Assumption, built by Charles Errard (born at Nantes in 1606, died 1698), which was commenced in 1670 (*pl.* 47, *fig.* 12, ground plan, *fig.* 13, view, and *fig.* 14, section). The church was completed within six years and is a round building, finished upon one side with a portico of disengaged columns and covered with a dome 63 feet, 3 inches in diameter, equal to that of the church. It is only to be regretted that the drum of the dome is too high, and the substructure seems, therefore, too low, although the perspective naturally mitigates this effect. This would still more be the case if the substructure was either broader or the drum somewhat contracted. In the front row of the portico stand six Corinthian columns, 28 feet, 6 inches high, the middle ones at 2, the rest at 1½ diameters distance. Behind each corner column stands a column at 1½ diameters distance from it and 1 diameter from the front pillar. The dome is of wood and its highest point is 150 feet from the floor of the church. It is well cassetted and rests upon ten pair of coupled Corinthian pilasters, surmounted by a complete entablature, upon which the drum of the dome stands, on an attic.

6. The Church of St. Sulpice in Paris. After Notre Dame and Ste. Genevieve, St. Sulpice is the largest church in Paris. It is in the Faubourg St. Germain and is upon the site where St. Peter's chapel stood in 1211, whose crypt was again employed when the architect Gamarre projected a new and larger church. This church was found inadequate to the wants of the congregation, and Le Veau, therefore, made a new design, for whose execution the corner stone was laid in 1655. After Le Veau's death the work was prosecuted by Gillard, and Oppenoord finished the side aisles, the transept, and the northern side portal. From 1730 the architect Servandoni continued the work and undertook, from his own drawing, the completion of the principal façade (*pl.* 49, *fig.* 4, ground plan, *fig.* 5, elevation). But he could not complete the towers, which were to be 220 feet high. After his death, in 1777, Chagrin altered the plan again, by bringing the octagonal towers planned by Maclaurin into harmony with the façade; but he did not complete them.

The length of the church is 360 feet, the width 150 feet, and its ground plan is similar to that of Notre Dame. The middle aisle, like the side aisles, is 110 feet high. The pillars are 6 feet thick and stand 18 feet apart. The connecting arches begin 27 feet above the floor. The transept, of the same width, is surmounted by a vaulted dome 28 feet high

at its intersection with the nave. In the rear of the choir gallery, which is 68 feet high, is the oval chapel of the Holy Virgin, 35 feet deep, 44 feet long, and 78 feet high, and surrounded with a wooden dome. The façade, which is 174 feet broad and executed after Servandoni's plan, has below four pairs of disengaged and four pairs of three-quarter columns of the Doric order. The former are 5 feet, 6 inches thick, and 43 feet high. Servandoni had introduced a gable between the bases of the towers, which was struck by lightning in 1770, and then removed.

7. The Pantheon, or the Church of St. Genevieve in Paris. With the erection of this church arose a new epoch in the architecture of France, as the corrupt Italian style was deserted and the forms of the antique were again introduced. The honor of this work belongs to Jacques Germain Soufflot (born at Irancy in 1714), who had studied in Rome. Whilst he was building the theatre in Lyons he went to Paris and was there named Director General of Public Buildings. The above-mentioned church was to be built at this time and Soufflot's plan was accepted, and in 1756 the corner stone of the church was laid. *Pl.* 48, *fig.* 3, shows the ground plan, *fig.* 4 the view, and *fig.* 5 the lateral section of the church. King Chlodovig had once built a church upon the same spot which was renewed in the 12th century, but in 1483 was ruined by lightning and finally replaced by the present building.

The form of the present church is a Greek cross formed of four aisles uniting under the dome. This at least was the wish of Soufflot, but the priests wished a lengthening of the choir and the main aisle. For this purpose pillar-arcades were introduced, which do not harmonize well with the columns. The desired two towers were also added in the rear of the nave, but they were afterwards removed. The beginning of the middle aisle forms a kind of fore hall, ovally vaulted, and with two tribunes. A third is over the entrance. The columns in the main aisle are 37 feet 8 inches high, and their axes are 14 feet apart. The diameter is 3 feet 6 inches, and the entablature one fifth of the height of the columns. The inner length to the wall of the niche is 282 feet, that of the transept 236 feet, and the inner width is 99 feet 4 inches. The middle aisle is 39 feet 6 inches wide, the side aisles only 9 feet 6 inches. The dome is 62 feet in diameter. The masonry occupies scarcely the 7th part of the whole area of the church, which is 52,992 square feet. It is very heavily taxed; for while the square foot of the pillars in St. Peter's sustains 21,910 pounds, and in St. Paul's church of London 36,059 pounds, the weight on the square foot in the Pantheon is 48,687 pounds. Each of the four principal pillars is 24 feet long and 14 feet 6 inches broad. They are connected by four large arches of 43 feet 2 inches span, and whose vertices are 69 feet 4 inches above the floor of the church. From them to the opening of the cap of the inner dome there is a height of 186 feet, 232 feet to the opening of the lantern in the third vault, and 258 feet to the top of the lantern. When the inner cap of the vault was finished in 1781, the pillars showed some cracks. Nevertheless the building was continued after a suspension of four years, occasioned by Soufflot's death, in 1782, with the erection of the peristyle of

36 columns around the drum. In 1788 the cupola proper was begun, and in 1790 the lantern was erected. On the 25th of August Quatremère de Quincy received the order to change the church into a mausoleum for those who had merited well of the country, and the church was called Pantheon. First the windows were all walled up and only those in the vault retained, by which the light was improved, as the church had been too light. The belfries were then removed, and all garlands, reliefs, and whatever indicated the church, were taken away. By the concussion occasioned by 200 laborers working without intermission more cracks appeared in the pillars and neighboring columns. Rondelet, who had prosecuted the building after Soufflot's death, investigated these, and found that they were partly attributable to the poor materials and partly to the reckless workmanship in the pillars. It was now intended to strengthen the pillars, as those of the crypt which supported them allowed their being made thicker. But the relatives of Soufflot protested against this alteration of his plan, and Rondelet finally conquered the difficulty by exchanging the poor stones and those that were improperly laid for good ones; and since then the Pantheon, which by Rondelet again was altered to a church, has required no further repairs.

8. The Madeleine at Paris. One of the most important modern buildings in Paris is St. Magdalen's church. In this the form of the ancient temples is entirely restored, and there is no trace of tower or cupola. *Pl.* 48, *fig.* 1, is the ground plan, *fig.* 2 the exterior perspective view, and *pl.* 46, *fig.* 1, the inner perspective view.

In the 15th century a chapel stood on its site, which was replaced by a church in 1660. About 1763 it was deemed necessary for the adornment of the city to build a large church in its place, and the architect Coutant d'Yvry drew a plan, a Greek cross with a dome, of which only a little was executed. In 1777 Couture made a new plan, also a Greek cross with a dome, peristyle, &c. But it was rejected, and the revolution intervened. At length in 1804 the government determined to erect, not a church, but a temple to the fame of the French nation, and the plan of the architect Vignon received the preference, after long consultations of various committees. The building has a substructure 12 feet high, to whose platform ascends on each narrow side an open flight of 32 steps. Forty-eight Corinthian columns form a grand peristyle around the building, eight columns in the front and rear and eighteen at the sides. The front portico contains four more placed behind the second and third front columns on each side. The building therefore is an octastylos peripteros, according to the classification of Vitruvius. The intercolumniations are 11 feet 8 inches, the diameter of the columns is 6 feet, and their height 58 feet 6 inches. The peristyle is 12 feet 3 inches broad, and the main wall is 6 feet thick. The breadth of the building is 138 feet; its length, without the steps, is 321 feet; and it covers an area of 44,298 square feet. In the interior are on each side four Corinthian columns 2 feet thick, for which the entablature is broken, and upon which rest the girt arches which support cassetted vaults with skylights, the only means of light save the door, which is 15 feet

broad. Each of the Corinthian columns mentioned stands upon a pedestal which rests against pillars ornamented with pilasters. Under each arch stand two pair of Ionic columns, and between these four columns, which are placed upon stylobates, stand two pillars, in front of which are two Ionic columns supporting an entablature and a gable. In the interior of the apsis stand, upon a continuous stylobate, twelve Ionic columns 10 feet high, with their entablature, over which, up to the chief cornice, are several panels adorned with sculptures. When the monarchy was restored, the temple of glory was changed into a church and dedicated to St. Magdalen as the bas-relief on the front gable indicates.

9. The Chapel of St. Ferdinand at Sablonville. The unfortunate event which on the 13th of July, 1842, terminated the life of the Duke of Orleans, oldest son of Louis Philippe, was the occasion of the erection of a beautiful building, of which *pl.* 50, *fig.* 4, represents the perspective view. The King of the French bought from the civil list for 110,000 francs the house of Cordier in Sablonville, before which the accident occurred, removed it, and on its site the architects Fontaine and Lefranc erected a mausoleum that was consecrated on the 11th of July, 1843. It forms a Greek cross, and is of the Byzantine style, whose rigor is somewhat softened by several antique motivos. A little turret with a cross surmounts the intersection of the aisles. In the right cross-arm is the altar of St. Ferdinand, in the left the cenotaph of the Duke, and in the high choir is the altar of our Lady of Compassion (*Notre Dame de Compassion*), whose statue also stands upon the exterior of the church in a niche of the wing. The three façades have rosette windows with painted glass representing Faith, Hope, and Charity. There are also arched windows with glass paintings from Sevres, representing various saints from designs of Ingres. The sacristy lies outside the chapel behind the high choir; and in the front wing, before which is a little open place, is the dwelling of the keeper. The cenotaph is executed in marble from designs by Ary Schefer; and a praying angel, one of the last works of the Princess Mary of Orleans, who died shortly before, is introduced.

C. Germany.

Germany does not lack churches of the time of the decline of art, but as they are mere repetitions of the Italian and French churches of the period, we do not notice them, but pass at once to some of the most modern buildings of Berlin and Munich, where architecture is now especially cultivated.

1. The Court Church of All Saints in Munich. Although king Maximilian I. of Bavaria did much for his country in architecture, yet its new era was reserved for the reign of Louis I., and that king, equally enamored of poetry and art, did not spare his private treasure in making for Munich an artistic period like the Augustan age in Rome. In all the churches of this period, although the antique is not avoided, the preference is plain for the Byzantine and the old German styles.

The Church of All Saints was built after the design of Leo v. Klenze. *Pl.* 46, *fig.* 8, shows the exterior, and *pl.* 49, *fig.* 7, the inner perspective

view. The church is built in the style of the 11th and 12th centuries, which is preserved throughout in its strictest purity. A high middle aisle is accompanied by two lower side aisles, and is lighted by little semicircularly arched windows. The interior contains broad pillars, between which arches are sprung supporting vaults. The main nave is separated from the side aisles by arcades which support galleries. The arches and domes are richly painted in fresco, and are well lighted by the front windows of the nave.

2. The Church of Mary the Helper in the Faubourg Au in Munich. This church was designed and executed by the architect D. J. Ohlmüller. *Pl.* 49, *fig.* 8, represents the inner view. The church, of which the German style of the 13th century is the basis, consists of three aisles equally high; the side aisles are half as wide as the main aisle. The ribs of the vaults are artistically arranged, and the nineteen windows are covered with very beautiful glass painting. The façade has a chief tower with a perforated pyramid, and two small contiguous towers upon the corner pillars. A gallery extends around the roof between the pyramidal turrets which crown the buttresses. The church has no transept, and the end of the choir is semicircular. The church was completed in 1831.

3. The Basilica St. Boniface in Munich (*pl.* 46, *fig.* 9) was designed by the architect Ziebland, and beautifully painted in fresco by Henry Hess. On the 12th Oct., 1835, the corner stone of this basilica was laid, and in 1840 the building was so far completed that the fresco paintings could be commenced, and they were finished in 1844. The church, in which prevails the old basilica style, forms a long rectangle with four colonnades, five aisles, and a semicircular vaulted apsis. In the interior there are sixty-six disengaged columns in four rows. The columns of the middle aisle are connected by round arches, upon which rests the high wall of this aisle, containing the windows. The main walls, with the exception of some arch frames, are built of bricks in their natural color. The middle aisle is 262 feet long, 52 broad, and 83 feet high to the entablature. The framework of the roof is entirely uncovered, and the blue surface of the roof painted with gold stars is visible through it. Each of the side aisles is 18 feet broad, and 44 feet high, so that the whole breadth of the church is 124 feet. The columns are 25 feet high, and each consists of one block of grey marble, but the capitals of white marble, upon which are carved vines and ears of grain as allegorical representations of the wine and bread of the Last Supper. All the paintings with which the walls of the middle aisle, the wall of the choir, and the choir niches are covered, were executed after cartoons of the artist Henry Hess, and under his direction. They are frescoes upon a gold ground, and represent partly scenes from the life of St. Boniface, partly the propagation of Christianity, or finally are portraits of saints and popes.

4. The Parish and University Church of St. Louis in Munich. This church was designed and built by Fr. v. Gärtner in the style of the 14th century, and painted in fresco by Peter v. Cornelius. *Pl.* 50, *fig.* 2, represents the exterior perspective view of this church, which consists of three aisles, and has an open portico in front between the towers. The church and towers are of red brick, coated with a cement imitating

white freestone. It was built at the suggestion and expense of the citizens of Munich, and has an inscription in the interior to that effect.

5. The Werder Church in Berlin. As Leo v. Klenze and Fr. v. Gärtner were the animating principles of architectural progress in Munich, so was Frederick Schinkel its genius in Berlin; and as they ornamented Bavaria, so did he Prussia, with buildings that indicate a pure sense of art, and the fruitful and earnest study of the architecture of all times and people. Schinkel's designs are diffused thoughout Germany, although Berlin is considered richest in them, and his school of architecture has sent forth a number of pupils who zealously strive to imitate his noble example. The design for the Werder Church, of which *fig.* 3 gives a perspective view from the south-west, was made in 1825, and was soon executed. The means appropriated for the building allowed only very simple forms in the exterior. Yet it lacks not ornament from the sculptures in burnt clay and moulded cornice-stones. Over the portal stands, after a design of Schinkel's, the archangel Michael, modelled by Wichmann, and the capitals also are finely executed in burnt clay. The interior of the church has a single aisle with five cross-vaults up to the high choir, which has a star-shaped vault of remarkable breadth and height, and makes a lofty and pleasing impression. It is beautifully decorated with oil paintings by Begas, Schadow, and Wach. The entire building is exclusively of brick, and not plastered.

6. The Garrison Church at Potsdam. This was also designed by Schinkel. It was originally intended to be only a substructure of square ground plan (*pl.* 48, *fig.* 7), with a portico and a semicircular apsis supporting a drum surrounded by a peristyle, and having a double dome. The bells were to hang in the belfries forming the front corners of the ground plan with a fore hall between them, which were not to be higher than the substructure. The four corners were to be adorned with sculptures, statues of angels, and candelabra; but as it was found that the bells did not sound loud enough, the two small corner towers were made higher, and thus the building received the façade which *fig.* 8 represents. There are no columns in the interior of the church, except in the three cross-arms arising from the inclosure of the two corner towers, and the corresponding sacristy and confessional in the rear corners, where galleries are supported by light columns. The square of the church has a side of 135 feet, and the whole height to the wings of the angel upon the lantern is 232 feet, to the vertex of the dome only 200 feet.

D. England.

When the English deserted the pointed-arch style and returned to the antique, Palladio became their model, and they have many buildings erected entirely according to his rules. We have selected for representation the most interesting edifice of this period, second in the whole world only to St. Peter's in Rome.

St. Paul's Church in London. Sir Christopher Wren (born 1632, died 1723) is justly reckoned among the most famous architects. He devoted himself with such zeal to mathematics, that in his 25th year he lectured

upon astronomy. Upon his return from his travels through France and Italy, he was appointed first Royal Architect, in 1668. In 1666, when the old church of St. Paul, in spite of Inigo Jones's repairs, threatened to fall, it had been resolved to build a new church, and Wren began it after his own design on the 1st of June, 1675. Originally his idea was to erect a building in the basilica style, but the orthodox clergy demanded a new design, of which *pl.* 49, *fig.* 1, is the ground plan, *fig.* 2 the western façade, and *fig.* 3 a lateral section west of the dome.

The length of St. Paul's is 530 feet, and in some places the foundations are more than 40 feet deep. There is a crypt beneath. The ground plan forms a Latin cross, with a transept 252 feet long. The middle aisle is 42 feet wide between the pillars, and each side aisle is 20 feet wide. The height of the middle aisle is 90 feet, the inner vault of the dome is 216 feet above the church floor, the outer to the foot of the lantern 280 feet. The lantern with the cross is 80 feet, so that the whole height is 360 feet. From the street, however, as the church has a high substructure, it is 372 feet. The outer breadth of the dome is not quite 100 feet, and its height is 56 feet, whence the dome forms a half ellipsoid. The church is faced with Portland sandstone, and was completed in 35 years, for in 1710 Sir Christopher Wren had the gratification of laying the last stone of the lantern. The church cost £747,954. Upon the landing of the great steps are six pair of coupled Corinthian columns 4 feet thick and 40 feet high, which support a complete entablature and an attic 3 feet high, over which again stand four pairs of coupled Roman columns 3 feet 2 inches thick and 33 feet high. These support a frieze with consoles 2 feet 6 inches high, a few connecting mouldings, and finally a lofty gable. Both stories are overloaded with coupled pilasters, niches, and gable windows. On each side is a small belfry 100 feet high, surrounded by Roman columns. That the façade fails to make the grand impression anticipated from its proportions is attributable to the following reasons: 1. The use of coupled columns on the façade, and a slight inequality in the intercolumniations in the two stories. 2. The intersection of the façade by the lower chief cornice and by the attic. 3. The paralysation of the effect of the great architectonic lines in the whole façade by the many coupled pilasters, niches, and gable windows. And finally, 4. The tasteless details of the two small belfries, and the disproportionate height of the gable.

The effect of the interior, however, is weakened by no defects, and its grandeur of proportions and neatness of execution are well calculated to make a deep and lasting impression on the beholder. It contains a great number of noble monuments to England's great men, among which are those of Abercromby, Pitt, Nelson, &c. Sir Christopher Wren, the architect of the church, is buried in it. His epitaph, which is in Latin, is short and appropriate in every respect except in being in a foreign language; the concluding sentiment, though frequently quoted, is worth repeating for its felicity of expression: *Lector*, *si monumentum requiris*, *circumspice* (Reader, if you seek his monument, look around you).

E. Russia.

At the time when Italy had only remains of the Roman monuments, and of the Greek and Etruscan, but already possessed large and beautiful Christian basilicas, when in France and Germany and England large churches shamed the works of past centuries, Russia was yet only inhabited by barbarians. In 957 the Russian princess Olga, the wife of Igor, was baptized in Constantinople, and returning to her native country, introduced civilization, together with the milder religion. From this period date the traces of the new Greek architecture which we meet here and there, as, for instance, the Kremlin in Moscow, built in the 14th century and destroyed in the year 1812. When Peter the Great removed his residence to the city of Petersburg, which he had founded, Russian edifices began to be built in a regular and modern style. Of these we have selected two for our account.

1. The Chapel of the Knights of Malta in St. Petersburg. The Emperor Paul I. had given a palace in St. Petersburg to the Knights of Malta, and permitted them at the same time to erect a Catholic chapel. At that time Giacomo Quaranghi lived in St. Petersburg (born in 1744 at Bergamo, and died there in 1820), and the knights applied to him for a design for the chapel, which would certainly have been very beautiful if they had executed the portico he designed. But instead of this, the building, founded on the 23d of August, 1798, received a façade which is represented in *pl.* 50, *fig.* 11, which has four Corinthian half columns, and two small columns with a gable as door ornament; *fig.* 10 represents the ground plan and the manner in which the chapel is united with the palace, and *fig.* 12 the lateral section of the chapel. The interior is in the basilica form, ending in a large apsis. Two rows of yellow marble columns divide the church into three aisles 51 feet high. The breadth of the chapel is 50 feet, its length 100 feet.

2. St. Isaac's Church in St. Petersburg. After the fire which destroyed in 1710 the wooden church of St. Isaac of Dalmatia, standing upon the site now occupied by the statue of Peter the Great, and the two churches of the same saint which were in time built in another place, after designs by Maternowi and Rainaldi, had fallen into decay, the emperor Alexander I. resolved to rebuild it in a simple but effective manner, and intrusted Monferrand with the design, which was accepted, and the erection of the building commenced on the 8th July, 1819. *Pl.* 47, *fig.* 7, shows the ground plan, *fig.* 8 the elevation of this church. Its exterior length is 312 feet, the inner 297 feet 6 inches, and the greatest breadth is 192 feet. It covers 580,322 square feet, and is consequently somewhat smaller than Notre Dame in Paris, and is to St. Peter's as 1 : 3.44. On each long side, one of which fronts on the Place of the Admiralty, opposite the statue of Peter the Great and the Neva, is a portico, closely imitated from that of the Pantheon at Rome, but much more imposing, as the columns, which consist each of a single block of Finland marble, are 12 feet higher than those of the Pantheon, being 56 feet high. The capitals and bases of the columns are cast in bronze. The short sides, which are east and west, have also porticoes, but less projecting, which were demanded by the rules

of the Greek ritual, according to which the high altar must be placed in the east and the church doors in the west. The interior is roofed with cassetted cylindrical vaults, which rest upon pillars decorated with columns and pilasters. The columns of the sanctuary are partly of jasper, partly of porphyry. Over the middle of the church is a dome 87 feet 4 inches in diameter, and whose height is 275 feet, and with the lantern, 327 feet from the church floor. The drum is surrounded by a superb Corinthian peristyle, whose entablature supports an attic with a balustrade, upon whose cubes stand statues of angels. The acroteria are also adorned with statues. Four small belfries covered with domes, on the corners of the middle building, injure the otherwise fine effect of this beautiful edifice.

2. Castles and Palaces.

A. Italy.

We must here again begin with Italy, because in this country, while the German style reigned elsewhere supreme, even in secular buildings, the introduction of a new style had commenced, which afterwards spread through Europe. We mention the prominent buildings in chronological order.

1. The Cancelleria in Rome. Bramante, whom we have already mentioned, meets us again in the most beautiful palaces of Rome. The palace of the Papal Cancelleria (*pl.* 52, *fig.* 3), whose right side includes the church of San Lorenzo in Damaso, which was restored about twenty years ago, is among the most noticeable of Roman buildings. Its façade, 254 feet long, is built of travertine taken from the old Coliseum. Two ranges of pilasters ornament the broad window-piers of the two chief stories, while the lower story has windows raised above a substructure of freestone in rustication. A bolder profile would be desirable in the cornices. The court of columns is especially beautiful, which below, as in the first story, consists of four pillars and twenty-two Tuscan columns, connected by semicircular arches, and whose passages have cross-vault ceilings. The shafts of the columns are each of a single block of granite, taken from the Basilica of San Lorenzo, which stood upon this spot.

2. The Casa Silvestri in Rome, of which *pl.* 52, *fig.* 10 *a* shows the ground plan, *fig.* 10 *b* the front, and *fig.* 10 *c* the rear view, is said to have been commenced by Baldassare Peruzzi of Volterra about 1502, although many, and probably justly, ascribe it to Michael Angelo. It is a small building, with a meagre main cornice, and overladen with subordinate cornices. The ground plan is like the antique Roman buildings, one of whichis represented in *fig.* 11; but the windows are too narrow, and disagreeable divisions arise from the omission of the vertical joints in the rustication of the first story.

3. The Palazzo Giraud in Rome (*fig.* 9) was begun by Bramante in 1504. It is situated beyond the Tiber, and was built for the Cardinal Corneto. It is almost a copy on a smaller scale of the Cancelleria, save that the windows of the first and third stories are alike. The pilasters here, as in the Cancelleria, project a little from the walls, a plan which

deserves to be imitated. Yet here also the main cornice is too insignificant, and the upper windows are too low.

4. The Palazzo Sora in Parione in Rome was built by Bramante in 1505. Its façade (*fig.* 6) is well massed, but the windows of the second story have three-cornered and round pediments, to which the under cornices offer an unfavorable contrast. The columned court of this palace is very beautiful.

The Palazzo del Te in Mantua, of which *pl.* 57, *fig.* 9, shows the ground plan, was begun about 1520 by Giulio Pippi, known as Giulio Romano. The name is derived probably, not from any resemblance to the letter T, which does not exist, but from an abbreviation of the word Tejetta (drainage), for the palace stands upon a ground drained by water furrows. The principal ground plan forms an exact square of 180 feet side, and incloses a court of 120 feet side. This court has two entrances, the principal one, consisting of a great gate with an arch in rustication, leading into a vestibule ornamented with columns, while the other, which is located at one of the sides, has three arches built in the same taste. The façades of the palace, both in front and rear, consist of an order of Doric pilasters, coupled at the corners. The panels with rustication in the lower story are interrupted by window openings which relieve the heaviness. The façades are surmounted by a Doric entablature with triglyphs and metopes. From the court, where instead of pilasters is an order of coupled wall columns, a loggia leads into the garden. The façade of this side represents a peristyle of 12 columns, two deep and coupled. The centre intercolumniation communicates with a bridge which separates two water basins. Beyond this is a parterre with greenhouses and household buildings. The garden terminates in a large semicircle. The length of the whole estate is 550 feet. The interior of the building is arranged in a masterly manner, and decorated with paintings by Giulio Romano and his pupils.

6. The Palazzo Sacchetti in Rome (originally called *Casa San Gallo*) was designed and built by San Gallo (died 1546) for himself, in the year 1530. *Pl.* 52, *fig.* 7, represents its façade. It is 111 feet broad and has a very beautiful door. The windows are four feet broad and are placed 9 feet, 3 inches apart. Those of the first story are unfortunately a foot narrower above than below. The main cornice is 3 feet in height and of the same projection, and is to the height of the building as 1 : 17. The rectangular court is surrounded by arcades beneath, resting upon imposts between which stand Tuscan pilasters.

7. The Palazzo Paolo in Rome (*fig.* 5) was built by Torriani, a pupil of San Gallo, with a handsome door and otherwise of good proportions, although the middle windows, from the varying width of the piers, fail to make an agreeable impression.

8. The Villa Medici in Rome, at present the French Academy, built by Alessandro Lippi, about 1551, is a well proportioned building. The width of the piers between the windows, the upper of which are, however, a little too low, as well as the pure and bold profile of the girth and main cornices, whose height and projection are equal to one seventeenth of the height of

the façade, shows the pure taste of the architect. A vestibule towards the court and garden is especially good. It is supported by six beautiful Ionic columns; *pl.* 52, *fig.* 8 *a*, shows the front façade, *fig.* 8 *b* the ground plan of the lower story.

9. The Palazzo Saoli in Genoa was built in 1553 by Alessi, who was for Genoa what Bramante was for Rome. This palace is a master-piece. It has two façades, as it is a corner house, and a garden lies before one of the façades. The street façade, including the entrance, has five openings in rustication constructed so judiciously as to make a very agreeable impression. The middle of the upper story consists of arcades upon columns, with a window upon both sides, with coupled pilasters, over which is a balcony. The interior of the court (*pl.* 51, *fig.* 5) is surrounded by two stories of piazzas, or vaulted galleries of marble columns, and has a magnificent effect, as well as the staircase. The extraordinary grandeur of these galleries is attained by connecting the columns in pairs by complete entablatures, and these again by arches sprung from their ends, whilst the vaults abut between and on the arches. The main cornice is well profiled, but too richly ornamented.

10. The Papal Palace in Rome. Domenico Fontana (born 1553, died 1607), known by a large number of fine buildings in Rome, by command of Pope Sixtus V., enlarged the Vatican with a building, the *Palazzo di Papa Sisto V.*, briefly termed the *Papal Palace. Pl.* 52, *fig.* 4, represents this building. It makes a grand impression, although it is not a large edifice. The round and triangular pediments over the door and centre window can, however, hardly be justified by good taste. The main cornice is beautifully and boldly profiled.

11. The Palazzo Doria Tursi in Genoa was begun in 1590 by Rocco Lurago, and is at present the property of the king of Sardinia. *Pl.* 54, *fig.* 3, shows the façade. It is almost too crowded with pilasters and gable-windows to be classed unreservedly with the good Italian style. On each side the fine vaulted portico supports a terrace adjoining the second story of the building. The cornice is remarkable for its very great consoles. The staircase, approached from the spacious vestibule, is numbered among the most perfect. The court is surrounded with columns and half columns connected by arches.

12. Palazzo Caserta near Naples. One of the largest European buildings of the last century is the Palace of Caserta near Naples. Vanvitelli, or more properly Louis van Witel of Utrecht, planned it and laid the corner stone on the 20th January, 1752. *Pl.* 51, *fig.* 1, represents the ground plan of the lower story, *fig.* 2 that of the main story, *fig.* 3 the elevation, and *fig.* 4 the section of the palace. The building has four courts and occupies an area of 410,480 square feet. Each of the two principal fronts has a large portal and two side entrances. On every corner is a pavilion of 161 feet in height and in the centre between the courts a dome covering the great vestibule, whose height is 183 feet from the floor. The main story, which is 26 feet high, rests upon a substructure which has two stories, each 18 feet high. The great saloons in the main story extend through

the upper building and are 45 feet high. The windows are 5 feet, 6 inches wide in the clear, and are placed 10 feet apart. Those of the main story are 12 feet high. Over this story is still another, 21 feet high, and an intersole, 12 feet high. In the middle of each façade stand four Ionic columns, and as many in the façades of the pavilions, which have flat roofs surrounded by balustrades. The plan of the arcades, which are 45 feet high, and connect the two portals, is magnificent. They have four passages, and in the middle they form the octagonal vestibule which contains the great staircase. At each portal is a vestibule ornamented with eight Corinthian columns. The columns consist each of a single block of ash-grey Sicilian marble. The great staircase, which also leads to the royal chapel, whose ceiling is supported by sixteen Corinthian marble columns, has steps 19 feet, 6 inches long, each of a single block of marble. In one side of the building is a theatre extending through two stories.

In order to show the style in which the Roman palaces were finished, we have represented in *pl.* 54, *figs.* 6–9, four superb doors from various palaces, and also in *fig.* 4 one of the many Roman fountains, the *Fontana Paolina*, not far from the church San Pietro in Promontorio upon the Janiculus. It was executed by Jacob Fontana, and is fed by the aqueduct of Bracciano, which lies 36 miles from Rome. Three large and two small arcades, whence falls the water in three streams into the broad basin, form the fountain. Between the arcades there are five half columns of granite, and over them an attic with an inscription, and then an arched superstructure with two angels bearing the papal arms. As an offset to this example of tastelessness, built in 1560, we give in *fig.* 5 the ancient fountain of Marius, not far from Rome, and it is curious to observe how human taste, when such guides were near, could go so far astray as to produce the Fontana Paolina.

B. France.

1. The Louvre in Paris. Of French palaces, the Louvre at Paris claims the priority of age; for in the 8th and 9th centuries there stood upon its site a palace of the King of France, which in 1529 was so ruinous that Francis I. determined to build a new palace in its place. Sebastian Serlio and Francis Lescot drew plans for it, and the latter was accepted. But at the death of Lescot even the wing towards the Tuileries, the old Louvre, was not yet completed. Its court façade (*pl.* 52, *fig.* 2) has in the centre a projection (*le grand avant corps*), and a little one on each side and in the corners. These *avant corps* are repeated on the other sides of the court. Before them stand forty-six pairs of fluted Corinthian three-quarter columns 2 feet thick and 19 feet 2 inches high, placed on high pedestals. Before the receding parts (*arrière corps*) are thirty-two pilasters of the same order ornamenting the window piers. Similar orders of columns and pilasters are repeated before the main story but in the Roman style, and each order has its full entablature. The ground floor is 33 feet high, the main story 29 feet. The length and depth of the Louvre are 525 feet. After Lescot's death Lemercier erected, over the middle of the wing towards the Tuileries, a high balustrade, and over that a rectangular drum with a dome of frame-

work which covers a large hall, resting in part on caryatides executed by Jean Goujon. Lemercier (born 1629) continued the wing towards the Seine, to the façade of which Claude Perrault afterwards added the remarkably beautiful colonnade represented in elevation and ground plan in *pl.* 52, *fig.* 1. The three older façades towards the court were then made to harmonize with it. After Perrault's death Gabriel continued the building of the upper part of the three older façades according to his own idea. When Louis XIV. wished to finish the Louvre there was a disagreement about the form of the outer façades. At the suggestion of Colbert, Bernini was summoned from Rome to Paris, but his plans were not approved of. It was then that Perrault designed his colonnade, which was completed in 1670. It consists of coupled fluted Corinthian columns 3 feet 9 inches thick and 38 feet high, placed upon pedestals over the lower story, and supporting an excellently profiled entablature, whose height is $2\frac{1}{4}$ columnar diameters. The column-couples are placed at distances of 3 diameters; the two middle ones 6 diameters' distance from each other. The four couples, or eight columns, in the centre support a triangular gable, whose crown cornice consists of two stones 54 feet long and 28 inches high. The façade towards the Rue le Coq has much beauty, especially an imposing carriage portal. In 1755 the exterior of the Louvre was completed. After the palace had been left to itself almost forty years Percier and Fontaine were ordered by Napoleon to improve it and arrange the interior tastefully. They opened the niches between the columns of the colonnade and changed them into windows. The two divisions of the colonnade were united over the middle door with a horizontal ceiling, so that now the communication appears no longer to be interrupted by the great arch. In spite of the triangular pediments over the windows of the main story, this façade is justly regarded as one of the finest of modern times, owing to the correctness of its proportions.

2. The Palace of the Tuileries in Paris was commenced in 1364 by command of Catharine di Medici, by Philibert Delorme and Jean Bullart, but was again abandoned until Henry IV. caused it to be continued on an altered plan by Ducerceau and Dupérai. It was finally completed under Louis XIV. by Louis le Beau and François d'Orbois. *Pl.* 53, *fig.* 1, gives a view of the Tuileries from the Place du Carrousel. The employment of so many architects has had the effect of producing a singular arrangement: there are roofs of five different shapes, and the whole building is without any essential æsthetic unity of design. The windows, which are six feet wide, have throughout piers of no greater breadth. Those of the first and second stories are 18 feet high; of the third, 16 feet. The entablature of the pilasters is intersected by the windows of the second story, and in the upper there are small pilasters standing over those beneath. The roof is disproportionately high, higher than half of the building. Altogether there are five pavilions, among which, besides the clock pavilion in the centre, the northern is interesting as the residence of Napoleon, of the Duchess of Berry, and finally of the Duke of Orleans; and the southern as the residence of Pope Pius VII. in 1804, of Charles X., and finally of Louis Philippe.

3. The Luxembourg Palace in Paris. When, after the death of Henry II., Maria di Medici wanted a palace for her own residence, she bought, in 1611, the old Palais Luxembourg, had it removed, and ordered Desbrosses to build a palace, of which the corner-stone was laid in 1615, and the Palazzo Pitti in Florence served as model. The plan of the Palais Luxembourg (*pl.* 53, *fig.* 4) is a rectangle. It has six large square pavilions, and is very regular. The north side has a row of arcades, over which there is an open terrace, which is divided into two parts by the dome over the entrance. The system of rustication prevails throughout the building, and there are no columns, scarcely any pilasters, and thence the building has an appearance of great strength, but it is also monotonous. The small dome is unimportant in itself, but it very happily interrupts the long line between the pavilions. The walls here recede above the main story, forming two galleries. Upon the middle pavilion is a sun-dial, upon which the meridian of mean time is indicated.

4. The Navy Department and the Garde-Meubles in Paris. In the year 1763 the Place Louis XV., now the Place de la Concorde, was designed. It was completed in 1772. Upon the north of this place stand two large buildings 288 feet long. Before the ground story of each is a row of arcades 10 feet wide, which form a covered passage 9 feet broad and 25 feet high. On both sides (*fig.* 2) of the façade are pavilions, upon whose substructures of bound masonry are four Corinthian columns crowned with a triangular gable, whose sides rest on pilasters. Between the pavilions stand twelve Corinthian columns 30 feet high and three feet thick, forming a terrace over the lower passage. The columns extend through two stories and stand 11 feet apart. These buildings were originally designed as storehouses of the furniture and jewels of the crown (Gardes-Meubles); but one was changed into the present Navy Department. Jacques Gabriel, a pupil of Hardouin Mansard, was the architect of these edifices, and they have the advantage of the Louvre in not having their columns coupled, whilst on the other hand they are too weak and low and their distances too great.

5. The Palace at Versailles. The royal pleasure grounds at Versailles were first planned by Louis XIII., but Louis XIV. caused the present palace to be erected after Leveau's designs. It is 1320 feet in length, and consists of a centre building with two wings. Its finest part is the grand colonnade after Mansard's design, fronting towards the garden. *Pl.* 54, *fig.* 1, gives the view of it. Unhappily the chief masses of the palace are injured by many projections and recedings, by which all the great architectonic lines are destroyed. The great entrance is truly insignificant, hidden as it is between the rear wings inclosing the open court which is 70 feet wide. The interior of the palace is magnificent, and Louis Philippe placed there the Museum, whose treasures are all of the grandest historical interest to France. One of the finest halls is the so called Battle Gallery (*fig.* 2) in the southern part of the ground story. It is 327 feet long, lighted from above, and contains in paintings, mostly by Horace Vernet, the history of Napoleon's campaigns from 1796–1815, and of the French campaign in Algiers. Some of the paintings are of enormous size: *the Battle of Isly* for

instance is 90 feet long. The busts of Napoleon and of the members of his family are also placed there.

C. Belgium and Holland.

A league and a half from Brussels, near the canal to Malines, is the *pleasure palace of Laeken*, erected in 1782 after the designs of Montemayor, but the interior was executed by Payen. *Pl.* 51, *fig.* 6, shows the ground plan, *pl.* 53, *fig.* 5, the front elevation. The façade is in the French style, and has in the centre a portico of four Ionic columns placed at distances of three and a half diameters, and on the corners pavilions with pilasters. The round hall in the rear of the vestibule is surrounded with twelve Corinthian columns, and covered with a dome, and is considered to be a structure of great architectonic value.

The Royal Residence in Amsterdam, built by Jacob Van Campen, born in Harlaem (d. 1658), is without question the most beautiful building in Holland. The grandeur of its masses, the regularity of its plan, the beauty of its construction, the richness of its decoration, all combine to make it one of the finest creations of modern architecture. *Pl.* 55, *fig.* 4, gives the elevation, *fig.* 5 the ground plan of the ground story, and *fig.* 6 that of the second and third stories. The dome, which is wanting in the elevation, is represented to the right, the line A A being that of its connexion with the clock tower. The building stands upon 13,659 piles driven into the morass, and forms a large rectangle of 282 feet in length and 222 feet in breadth. The plan is imposing, the interior arrangement judicious, the communications convenient and easy, and all combined with taste and skill. The height of the façade is 116 feet. Upon a large substructure, forming a very subordinate story, with seven low entrances, there are two tiers of pilasters, the upper belonging to the composite, the lower to the Corinthian order. They are 36 feet high, each reaching through a story and an intersole. The façade has three projections, the middle one being both broader and deeper than those at the ends. This middle projection has a gable with a beautiful bas-relief representing the power of Amsterdam, and the acroteria of the gable support bronze statues twelve feet high.

D. Great Britain.

The castles and palaces of England are for the greater part of the mediæval style, which was widely employed for secular buildings after it had yielded in other countries to the Italian, and it is still much used. Next to that we find the manner of Palladio, and especially in country seats, which are often of very great extent. Such, for instance, is the country seat of the Duke of Argyle in Dumbarton county in Scotland, whose ground plan (*pl.* 51, *fig.* 7) is much like the castle at Laeken, and whose façade is almost precisely the same.

3. Theatres.

A considerable degree of luxury has always prevailed in the building of

theatres, not alone among the Greeks and Romans, but in modern times; and there has been an effort to give them an exterior adequate to the sumptuous splendor which characterizes the modern dramatic art. In the division of this work devoted to the Fine Arts we shall speak of the plans of theatres, and especially of their interior construction, and therefore will here record only one of the most beautiful German theatres, begun in 1837 and finished in 1840, the theatre in Dresden, designed and executed by Semper (*pl.* 57, *fig.* 4), and one of the largest theatres, that of St. Petersburg, built about thirty years ago by Montron (*fig.* 5, front view; *fig.* 6, ground plan).

The appearance of the *Dresden Theatre* is unique in this, that its exterior is of the same form as the interior. The chief entrance is at the end of the ellipse, while the carriage portico is at the side. The upper part of the façade is rather heavy for the fine, light arcades of the lower. In the interior arrangement, the judicious distribution of the apartments, and the spacious vestibule and foyer, deserve unqualified praise. The latter are remarkable for their beautiful fresco paintings.

The Theatre in St. Petersburg was built under the Emperor Alexander, and is singularly regular. By the arrangement of the rear, it is susceptible of being enlarged upon special occasions. As it is 360 feet deep in itself, enlargement is, however, very rarely required. The façade, with its eight Ionic columns, is imposing.

St. Charles Theatre, in New Orleans (*fig.* 7), fails in its exterior, and may be quoted as an example of bad arrangement of the façade. The portico reaches through two stories, and is covered with a heavy gable. There are Corinthian columns above, standing upon high pedestals. It is much too heavy for the open wall behind, which seems hardly calculated to support the heavy superstructure.

4. Museums.

During the two last centuries, the care for the better arrangement and preservation of objects of art, like the sense of true art, had apparently lost all vitality. Only recently have objects of art begun to be collected in buildings specially constructed for the purpose, and affording greater convenience of observation and study. We have selected a few of the best buildings of this kind for special notice.

The Museum in Cassel (*fig.* 13), which contains also the library, was planned by du Ry. It is 294 feet long, and its façade is decorated with Ionic pilasters, and has a portico of eight Ionic columns. Over the large round hall is a tolerably high dome, with a drum, surrounded by Corinthian pilasters. Although the whole makes a pleasant impression, yet the details belong to a period whose predominant corrupt taste precludes the possibility of anything very beautiful. Nevertheless, the building has just claims to admiration from its perfect interior arrangement.

King Louis I., of Bavaria, in order to collect into appropriate buildings

the various treasures of art dispersed in his palaces, and amassed during his travels, built in Munich *the Pinacothek* for the paintings, and for the sculptures *the Glyptothek*. Of the latter, *pl.* 53, *fig.* 6, shows the ground plan, and *pl.* 56, *fig.* 2, the perspective view. It was commenced in 1816 and completed in 1830, and reflects the highest honor on its architect, Leo v. Klenze. It surrounds a rectangular court, and is built in the Grecian style. In front is a portico of eight, in the rear one of four, Ionic columns. As the whole hall is lighted from above and from the inner court, it has no exterior windows, but in place of them niches, in which are placed statues of famous painters and sculptors. There are nine colossal figures in the front gable, representing Minerva and the plastic arts. The interior contains twelve halls, with friezes and ceilings painted in fresco by Cornelius, Haydegger, Zimmermann, Hermann, and others, and marble floors. The correctness of its proportions, and the noble simplicity of its motivos, make this building a model of good taste, worthy of being minutely studied by architects, along with the finest monuments of antiquity.

Opposite the Glyptothek is the newly built edifice for the exhibitions of art and industry (*fig.* 3, perspective view). This building is similar to the opposite one in form and plan, but very inferior to it in point of correctness and decoration, besides having the great fault of not answering the purpose for which it was constructed, since its door is so small that wall-paintings cannot be brought in for exhibition. The eight columns of the portico are very beautiful, and of the Corinthian order. In the gable-field is likewise a rich sculpture composition, representing Minerva as the tutelar deity of the arts and crafts. The general effect of the building is very good, and if it were not for the gem opposite it would certainly command considerable admiration.

5. City and Council Houses. Government Buildings.

The council houses of cities and houses erected for the meetings of the legislative bodies of states or confederacies, are usually, in their exterior appearance, expressive of the dignity of their purpose. Their prominent features are, generally, durability and simplicity, though from the latter rule there are some notable exceptions. We have selected a few examples of this class of buildings.

The City Hall at Maestricht, of which *pl.* 55, *fig.* 7, is a view, was erected in the middle of the eighteenth century, and rests entirely upon a mass of piles, over which is a tolerably high substructure. This is ascended by two flights of steps, which lead to the portico consisting of four Ionic columns upon high pedestals. The façade has two tiers of pilasters. The lower ones are Ionic, placed upon high pedestals, whose cornices extend across the entire front. These pilasters support a complete entablature, and upon that is the second tier of Corinthian pilasters, resting also upon pedestals. The middle building rises over the chief cornice, and has Roman pilasters, whose entablature supports a gable with good reliefs. Over the

whole is a bell-tower with arched openings and covered with a dome. The building is, on the whole, well proportioned, although many of the details lack good taste.

Much better is the *town-hall in Neuenburg* in Wirtemberg, built in the present century, and of which *pl.* 55, *fig.* 9, shows the view, and *fig.* 8 the ground plan. The portico, of six Ionic columns, is well proportioned, and the arcade which ornaments the front side is of good effect. The windows are rather low, which is the more striking on account of the heavy cornices over them. The large hall in the interior, extending through two stories, is very beautiful. Its two tribunes rest upon six Corinthian columns each.

The Capitol at Washington, of which *pl.* 56, *fig.* 1, gives a perspective view, is the seat of the Congress and of the Supreme Court of the United States of North America. This handsome building, erected in the year 1814, is elevated upon a hill 78 feet high, and consists entirely of marble. It is 362 feet long, 120 feet deep, and has three domes, the highest of which is 120 feet. The front of the building has a portico of eight Corinthian columns, with a wing-portico of five columns on each side, receding about one columnar distance, and bears a finely decorated gable. On the rear is a colonnade of 10 Corinthian columns, forming a gallery in front of the library room. The windows on the whole circumference of the building are laid between Corinthian pilasters. The façades would merit to be classed among the best, if it were not for the tasteless mixture of differently shaped windows. The interior plan is susceptible of great improvement, as there is a sad want of room for the transaction of business. Besides, no regard has been had in the construction to the laws of acoustics, so that the edifice is far from being adequate to its purpose. The great rotunda in the middle of the principal floor is surmounted by the great dome, which is very valuable in point of construction.

6. Exchanges.

Exchange buildings would answer their nearest purpose of affording places of meeting for merchants for the transaction of mutual business, if they were merely, as in former times, spacious inclosures sheltered from the weather by roofs only. Such were the ancient Greek *stoæ*, and similar halls or inclosures were for a long time found all-sufficient for the wants of the merchants. More recently, however, it has been found very convenient to connect with these places of meeting a number of offices with which the greater number of merchants have daily business, and hence the open halls have been abandoned for solid, and for the most part magnificent edifices, affording room for banks, insurance companies, commercial reading-rooms, and sometimes the post-office, besides the great hall where the merchants and brokers meet for business transactions. The plans of the Exchanges of Paris (*pl.* 56, *fig.* 6, ground floor, *fig.* 7, upper story) and of Ghent (*fig.* 8, ground floor, *fig.* 9, upper story) will serve as illustrations; the

large halls being the places of meeting, the smaller apartments serving various purposes of the above-mentioned nature.

The Exchange in Paris (*fig.* 5, perspective view) was built after the designs of Brogniart. It forms a rectangle of 69 metres by 41, and is erected on a substructure about 3 metres high, on which is a peristyle of 66 Corinthian columns, 1 metre in diameter and 10 metres high. The entablature resting on these columns is surmounted by an attic without any ornament, which hides the roof. The wall proper is interrupted by two rows of windows, separated by a Doric entablature. The introduction of these tasteless windows in connexion with the beautiful peristyle, is altogether unaccountable. Much superior in this respect is the granite portico of the *Exchange in New York* (*fig.* 4, perspective view), which exhibits a perfect unity of taste, and is one of the boldest edifices of recent times.

The Exchange of London (*fig.* 11) has a fine portico of eight Roman columns, but the whole façade is spoiled by the tasteless arched windows and the door behind it, as well as by two entirely inappropriate arches in the attic over the gable.

The Old Exchange in Amsterdam, of which we have given a section in *pl.* 57, *fig.* 14, has the original character of this style of building, a large court surrounded by covered galleries as protection against the weather, and in the upper story the necessary rooms for business and chambers of commerce.

7. Universities.

The plan of the building for a university must be modified by the various necessities arising from the number of professors, of necessary recitation rooms, of students, of laboratories, museums, &c., and no general rules can be given. But as this is a matter of theoretical architecture, we will here confine ourselves to the description of a few buildings belonging to this class. One of the most modern buildings of this kind is the *University of Ghent*, whose façade is seen in *pl.* 56, *fig.* 10. It was erected at the expense of the city of Ghent, and was designed and executed by Rouland. It contains a fine round hall, whose cassetted dome is supported by eighteen Corinthian columns, and surmounted by a lantern through which the hall is lighted. This hall is reached by a double-armed state staircase with twelve columns, whose wood-work ceiling is also cassetted, and through a superb vestibule, whose ceiling rests on four Corinthian columns. Before the building is a grandiose portico consisting of eight Corinthian granite columns, the field of whose gable is decorated by an excellent bas-relief.

The Paris Observatory (*pl.* 57, *fig.* 3, ground plan; *fig.* 2, northern façade) was built under Louis IV. by Claude Perrault. The building consists of four chief parts: of the centre, a rectangular tower whose sides face the four quarters of the heavens, the north projection with a gable, and two octagonal towers on the ends of the south side of the building. In the ele-

vation the building has, besides the ground floor, a kind of intersole and a main story, and is covered with a flat roof. The great windows of the main floor are arched and all the stories are vaulted. Through all the vaults an open space passes in the middle of the building to the cellar, for experiments with freely falling bodies. The building is extremely sound, and throughout in a pure style, so that it makes a good impression. But a great fault is that it is so inadequately planned that on the east side a new building was necessary for the astronomical observations. This fault is ascribed to Cassini.

8. Assembly Houses.

These buildings, again, depend for their plan upon many circumstances, as whether the place is much visited, whether it is for men only, and has consequently reading-rooms, billiard, and coffee-rooms, or whether balls and assemblies are held there. One of the prettiest edifices of the kind is the *Casino in Liège* (*fig.* 10, view; *fig.* 11, ground plan of the ground floor; *fig.* 12, plan of the upper story). The building stands upon a terraced hill, and has in front a grand double-armed staircase which leads to the terrace before the building. In the rear the ground floor divides into two parts, between which is the carriage way. Upon the ground floor of the front there are great halls and card rooms. In the rear building is the staircase and some other assembly rooms. The first story contains in the front building the great ball room, and on both sides terraces over the card rooms of the ground floor. As the carriage way is built over in the upper story, the rooms of the rear building communicate immediately with those in front.

A peculiar kind of buildings for guests are the *Persian Caravansaries.* These buildings are especially devoted to the entertainment of caravans. Erecting them is a meritorious work, and they are under a public superintendent. They take the place of our assembly and coffee-houses. They consist generally of a four or eight-cornered court, mostly with a fountain in the centre, and surrounded by the building, affording opportunity for exercise either under the arcades or in the free air. *Pl.* 57, *fig.* 15 *a* and *b*, are ground plans of such caravansaries. The building around the court consists only of single cells. The outer ones serve as shops for the traders or as coffee-houses, the inner ones for lodging the travellers, who make themselves at home there, and must themselves provide for their wants. The beasts are also sheltered here. The institution of caravansaries is very old, for Herodotus mentions them and calls them *catalysais.*

9. Watch-Houses, Custom-Houses, Excise-Houses.

Custom-houses are situated either at the gates of cities, if they serve for the reception of the barrier tax, and are then called excise-houses, and are

very subordinate buildings, at most an ornament of the gate, or they are destined for the collection of the state duties, and stand then generally near the wharfs or freight depôts. They contain various offices, a hall of sessions for the officials, and sometimes dwellings for one or more of them. The custom-house of New York (*fig.* 8), built in a fine old Doric style, is admirable as an ornament, but certainly suggests upon the exterior anything rather than a building for the collection of duties. The façade, of a fine Greek temple style, is built of white marble, and being placed on a considerable substructure, has a very good effect.

Watch-houses are public buildings for the accommodation of soldiers or officials who have charge of the public peace. They are therefore very simple, often included in the excise building, or are decorations of the gate and the open square. They contain nothing but the rooms for the officers and men, and a chamber of confinement for the arrested delinquents. The decoration of these buildings is very various. Those of the residential cities are usually very handsome. When Paris was made a fortress, a certain system was introduced in this matter. Watch-houses were placed in the interior of the city (*pl.* 57, *fig.* 16 *a*, ground plan; *fig.* 16 *b*, elevation), and were manned by strong detachments of the National Guard, and Vedette houses (*fig.* 17) for subordinate posts. These watch-houses are so arranged that they can be defended for some time against a superior force; some are even furnished with light cannon.

10. Honorary Monuments.

Honorary monuments are erected either for the commemoration of great events or of great men, and there are very various ideas of their construction from a simple statue to columns and arches of honor. The use of them dates from the most remote antiquity, but modern times have abounded in monuments to individuals, many of whom were very much honored and very little fed while they lived. We will describe some of these modern monuments.

In commemoration of the great victory which Napoleon had achieved as in a whirlwind, he resolved in the year 1806 to erect a superb triumphal arch, the present *Arc de l'Etoile* in Paris (*pl.* 57, *fig.* 1). The ground was so unstable that an artificial foundation was necessary to secure the building. When Napoleon married Maria Louisa of Austria, the building was scarcely above the foundation, and it was finished for the occasion of their entrance into Paris with wooden scaffoldings, covered with linen and painted, so that the architect Chalgrin had the rare fortune of seeing the model of his building in the natural size. In 1811 it was continued by the architect Goust; in 1814 it was interrupted; and in 1823 Huyot and Goust began it again. In 1828 it stopped again, and in 1832 Blouet was ordered to complete it as rapidly as possible, and in 1836 it was finished, after an expenditure of about ten millions of francs. The monument is 137 feet long, 68 feet broad, and 152 feet high. The middle arch has a span of 90 feet. The reliefs upon the side

visible in our drawing represent on the right the departure of the army in 1792 : the Angel of Glory summons the people; on the left is the triumph of Napoleon in 1810, by Cortot: Napoleon protected by the Angel of Glory is crowned by Victory. Upon the opposite side is the defence of the French people in 1814 and the Peace of 1815. In the upper part the figures appear in modern costume, and here are the Battle of Aboukir, the death of General Marceau, the Battle of Austerlitz, &c. The frieze contains historical reliefs, and in the attic are shields with the names of the victories. In the walls are steps by which the summit of the arch is gained and a fine prospect commanded.

We must here mention two monuments of similar import, the *Column of the Place Vendôme* and the *Column of July* in Paris. In the middle of the Place Vendôme was erected in 1699 an equestrian statue of Louis XIV., modelled by Gerardon, which was destroyed upon the day of the execution of Louis XVI., who was forced to behold the outrage. When Napoleon seized the reins of government, he resolved to immortalize the battle of Austerlitz, and to erect a column after the model of Trajan's Column in Rome, and from a drawing of the architect Lepère. It was erected of stone, and surrounded by 274 bronze reliefs from Bergerel's designs, spirally arranged in 22 windings. The column is of the Tuscan order, 108 feet high, and with the substructure 124 feet. The shaft is 11 feet thick. *Pl.* 53, *fig.* 7 *a*, shows the column as it now is, and *fig.* 7 *b*, a view of its prototype, the Column of Trajan. The colossal statue of Napoleon was 10–11 feet high, and represented the emperor in antique warrior's costume, resting with the right hand upon a sword, and bearing in the left a globe with the victory (*fig.* 8). But it was removed in 1814. After the revolution of July it was resolved to replace the statue of Napoleon upon the column; but his modern costume was chosen (*fig.* 9) on the one hand because it had become world-renowned, and on the other because all the figures in relief were in modern costume. The metal of the column weighs 1,800,000 pounds, and it was built of captured cannon. The labor alone cost 1,200,000 francs. Upon the pedestal is the Latin inscription represented in *fig.* 7 *c*, and on the upper part of the capital a French one, relating to the building of the column, begun under Denon, Lepère, and Gondoin on the 25th August, 1806, and completed on the 15th August, 1810.

Upon the site of the Bastille destroyed on the 14th July, 1789, it was proposed to erect a fountain, with an elephant 40 feet high, the plaster model of which still exists. But after the July revolution, it was determined to decorate the place with a column in remembrance of those who had fallen there; and Louis Philippe on the 28th July, 1831, laid the corner-stone, and on the 29th July, 1840, it was consecrated. *Pl.* 53, *fig.* 10 *a* gives the view; *fig.* 10 *b*, the inscription upon the pedestal; and *fig.* 11 a view of the Column of Antonine in Rome, which served as the model. The Column of July stands upon a vaulted foundation, through which passes the canal of St. Martin, and it has a double substructure, one round, with an inner gallery, and one square, over it, of granite and white

marble, in which are the beginnings of the steps upon which the column is ascended. It is of the Corinthian order, and the pedestal is adorned with inscriptions, palms, laurel crowns, oak branches, the arms of the city of Paris, the Gallic cock and the lion, the zodiacal sign of July. Upon the shaft, divided into three parts, are recorded in gold letters the names of the victims of July. The statue of the Genius of Freedom with a torch and a broken chain in the hand is by Dumont. The column is entirely of bronze, 133 feet high, and the lower diameter is more than 11 feet.

Another monument of honor is the *Valhalla* near Ratisbon (*pl.* 55, *fig.* 1, view, *fig.* 2, section), which king Louis I. of Bavaria erected to the memory of distinguished Germans. It forms a Doric marble temple, and was founded on the 18th October, 1830, planned and executed by Leo v. Klenze, and dedicated on the 18th October, 1842. The monument stands upon a hill on a foundation 126 feet high. The temple is 70 feet high, 100 feet broad, and 300 feet long. In front is a double portico of eight columns; each side has seventeen columns, and the rear eight again, so that the temple is a peripteros. The gable-fields are decorated with reliefs by Rauch and Schwanthaler. The southern slope of the hill is made accessible by steps up seven terraces of Cyclopean work, one above the other. The exterior is finished with unusual splendor. The walls and roof are painted in several colors. The ceiling is pendent, being fastened to the roof, and ornamented with rich metal cassettes. The illumination is from above. The upper entablature is supported by caryatides standing upon a cornice supported by pilasters, which divides the walls into an upper and lower part. The paintings of the frieze are by Wagner. Between the entablature and the pendent ceiling are figures from the northern mythology. The hall is decorated with the marble busts of distinguished Germans, standing partly upon pedestals, partly upon consoles, and executed by German artists only. There is room for one hundred and forty busts; about ninety have as yet been placed. Victories by Rauch and candelabra (*fig.* 3 *a* and *b*) interrupt the monotony of the rows of busts. On the north side is a small hall with columns supporting the floor of an upper hall which opens into the interior of the building. Southward in the subterranean part is a kind of crypt, where are placed the busts of those who are to have a place in the Valhalla after their death.

11. Halls and Bazars.

Market halls belong to the most sensible institutions of the ancients, revived in our day, and are no less useful to the public than to the traders. One of the finest is the *Grain Hall in Paris.* (*Pl.* 58, *fig.* 1, gives the half outer view; *fig.* 2, the half section; *fig.* 3, the ground plan of the lower; *fig.* 4, the ground plan of the upper story.) The hall was begun in 1762, and was finished in 1772. The President of the Board of Merchants, Viarmes, undertook the building after the designs of Comus de Mezieres. The ground plan is a complete circle, whose outer diameter is 68 metres,

and the ground floor, which has 28 arcades, is excellently vaulted. A double winding staircase serves for communication. Originally the building consisted of these arcades only, but in 1782 the court was covered with a dome of framework, designed by Legrand and Molinos, and executed by Rubo. The diameter of this dome is 126 feet, and its height is 100 feet. In the year 1802 the dome was burnt, but in 1811 was restored, of the same dimensions, but of iron with a copper roofing. Upon the side of the hall is a column (*fig.* 1 *A* and *A*), which was erected by Catharine di Medici, and served her as an astronomical observatory. Now there is a remarkable sun-dial of Pingré's upon it. *Pl.* 51, *fig.* 8, gives the ground plan of the ground floor, and *fig.* 9 that of the chief story of the *grain market at Corbeil* near Paris, which contains store-rooms for corn and meal.

The Market of St. Germain in Paris (*pl.* 58, *fig.* 5, inner view; *fig.* 6, section; *fig.* 7, ground plan) consists of a rectangular building inclosing a court and containing 400 stalls. The length is 276 feet, the breadth 216 feet, and the depth of the part covered with building, 42 feet. The building was commenced on the 15th August, 1813, by Destournelles. In the centre of every side there are three arched passages 30 feet high. All the arcades are furnished with blinds, and under the roof there are openings for ventilation, the beams of the suspension roof resting on little pillars projecting above the side walls. In the middle of the court B is a fountain. A distance of 34 feet separates the large market from the meat market C. It is 220 feet long, 42 feet deep, and was planned in 1814 by Blondel. Under this are cellars, which are lighted by windows in the lower wall of the building. This hall has 20 divisions with about 150 stands, and in the middle a large vestibule.

The Magdalen Market in Paris (*fig.* 9, lateral section; *fig.* 10, general ground plan) was completed in 1836, and serves for the vendors of flowers and vegetables. Upon the sides are large and small hall-like stands for business, but in the middle only open stalls. All the ridges of the roof are of iron, and the covering of sheet-iron.

The Market at Pavia (*fig.* 8, half view; *fig.* 11, half ground plan) was built in 1837, and contains, upon the front side, a colonnade for the stands, but in the rear a number of sitting rooms for the hucksters, and over these chambers smaller ones in the attic.

The Market Hall in Florence (*pl.* 51, *fig.* 10, ground plan; *fig.* 11, view) was built in the sixteenth century by Bernardo Tasso. It consists of twenty Ionic columns, 2 feet 7 inches thick and 23 feet 3 inches high, and eight pillars. It rests upon four steps. The shaft of each column consists of one block of grey granite from Fiesole. The columns of the loggia have Corinthian capitals. Upon the corner pillars are niches for placards.

The Fish Hall at Marseilles (*fig.* 12, ground plan; and *fig.* 13, elevation) is, like those of Ghent and Bruges, only an imitation of the fish hall built at Florence, in the sixteenth century. It is a double hall, with a wall running lengthwise through the middle. The roof rests upon eighteen Ionic granite columns and two pilasters.

As an example of the hugeness of market halls in the East, we have re-

presented in *pl.* 58, *fig.* 12, a part of the view, and *fig.* 13, a part of the ground plan of the *Almeidan at Ispahan*, in Persia. The whole building contains selling stalls, distributed through many stories. It surrounds a large court C C, to which is adjoined a spacious colonnade. Large entrances, A, B, D, E, F, G, lead into the inner stalls, and on the inside a lane passes before the stands, every building having four rows of stands, of which every two stand with their backs to each other.

12. Prisons.

In the construction of prisons, meaning those which are also work-houses, many systems are adopted, according to the manner in which the prisoners work, together or separately, and whether strict silence is to be observed, &c. The last-named system arose in America. This is not the place to speculate upon the characteristic advantages of these systems. Yet the American system greatly prevails. Generally, the prison-houses surround several courts, as the prison at Aix (*pl.* 57, *fig.* 18), to separate the sexes, and even the classes of prisoners from any intercourse. *Pl.* 59, *fig.* 15, shows the ground plan of the prison of Newgate, which is not a work-house, on which account the cells are larger, and no regard is had to a hall for labor. The jail at Ghent (*fig.* 16), recently built, and upon the cell system, forms an octagon, and all the entrances of the cells are in the form of radii from the church placed in the centre. In the prisons of Milan (*fig.* 17) and Amsterdam (*fig.* 18), the labor is in common, and only especial criminals are separated into single cells.

We shall give some details of the new prison at Halle, because it is often quoted as a model institution. *Pl.* 59, *fig.* 1, gives a perspective view of the whole institution, and *fig.* 2, the general ground plan. A is the chief building, of which *fig.* 3 shows the ground plan of the cellar story, *fig.* 4 that of the first story, *fig.* 5 of the second, which is like the third, and *fig.* 6 is the ground plan of the four stories, with the church. *Fig.* 7 is the front, and *fig.* 9 the side view of the main building; *fig.* 8 its lateral section, and *fig.* 10 the longitudinal section. *Fig.* 2, B, C, and D, are the prison-houses, connected by bridges *a b* with the church in the main building. E is the entrance building, F the bath and wash-house, whose ground plan is seen in *fig.* 13, and the side view in *fig.* 14. G is the lazaretto, whose ground plan is seen in *fig.* 11, and the side view in *fig.* 12. The whole establishment is surrounded by a wall, inclosing courts and gardens for recreation and labor in the open air.

13. Bridges.

As in the other buildings we have described we have omitted technical details, so we shall do with the bridges, of which we will describe a few of the most famous.

1. Italy. One of the most beautiful bridges is the covered bridge over

the Ticino, near Pavia (*pl.* 60, *fig.* 17). It is 700 feet long, 70 feet broad, and 108 feet high, and has seven Gothic pointed arches, 66 feet wide and 60 feet high. The covering has several stories. The great mass of the building is of brick, the little columns which support in double rows upon each side the covered way for pedestrians are of colored, and the bases and capitals of white marble, of which also the balustrade and other architectonic parts are made. Over the arches are arabesques, with gilding upon blue ground.

The covered bridge over the Rialto in Venice (*pl.* 60, *fig.* 1, view ; *fig.* 2, section) was begun in 1560 by Antonio Conte del Ponte, and finished in 1591 by Dyonis Boldo. It is a master-work. A single flat marble arch, 90 feet wide and 19 feet high, supports the street of the bridge, which is inclosed upon both sides by arcades of marble used as shops. The bridge ascends and descends by three marble steps, and hence its peculiar form.

The curved bridge (Ponte corvo) over the Melfa, near Aquino, was planned by Stefano del Piombino. The ground plan forms a sextant. Stefano's son and the Genoese Fra Jocondo completed the work in 1505. It is 600 feet long, 42 feet broad, and consists of seven semicircular arches (*fig.* 16). The middle arch has 88 feet span, the last and smallest 70 feet. The pillars increase in thickness symmetrically from 10–12 feet, and stand upon a common foundation. The bridge is built in a simple and imposing style.

2. France. The bridge *Notre Dame*, over the Seine in Paris (*fig.* 10), was built by Fra Jocondo in 1507, after the stone bridge of 1412 had been destroyed in 1499. It is 380 feet long, 73 feet broad, and has six semicircular arches averaging 53 feet span. The pillars are 12 feet broad and have three-cornered heads.

The bridge *Ste. Marie* in Paris (*fig.* 8) was begun in 1613 by Christopher Ste. Marie, and completed in 1635. It is an imitation of the beautiful bridge of Augustus near Rimini, 335 feet long, 72 feet broad, and it has seven semicircular arches of 42–55 feet span.

The bridge of *Neuilly* over the Seine, near Paris (*fig.* 9), one of the most beautiful and imposing of bridges, was begun in 1768 by Perrot, and finished in 1774. It is 876 feet long, 45 feet broad, and consists of five large, depressed, basket arches, constructed from eleven centres, of 120 feet span, and 30 feet high. Each top surface of the arch ends in a flat arch, whose union with the basket arch of the bridge vault produces an oblique vault (*cow's horn*). At the key-stone the arch is 5 feet, and the oval-headed piers are only 13 feet broad.

The bridge of *St. Maizence*, over the Eure, built by Perronet in 1774–84, is 252 feet long and 39 feet broad. It has three very flat arches of 72 feet span (*fig.* 12) and 4 feet 6 inches thick at top. The piers are only 18 feet thick.

The bridge of *Gignac*, over the Herrault (*pl.* 60, *fig.* 7), was begun in 1777 by Garipuy, and finished in 1793. It is 558 feet long and 80 feet high, with three large arches, the middle of which has 150 feet span and is 50 feet high. The two other arches are semicircles of 77 feet diameter. The piers of the bridge are 24 feet broad.

The bridge of *Tilsit* or Bellecourt, over the Saone, near Lyons (*fig.* 18), was begun in 1789 by Varegua and Vimar, and was completed in 1810. It is 422 feet long, and has five basket-arches 64 feet in width and 20 feet high. The pillars project and rise to the railing, where they bear inscriptions. They are semicircular. The cornice exhibits consoles, and the bridge-way is horizontal.

3. ENGLAND. The bridge over the Taff (*fig.* 15), in Glamorganshire, was built of brick in 1756. It consists of a single flat arch 132 feet wide and 33 feet high, the widest arch in England and the seventh in the world. Over each shank are three circular bridge eyes, which materially lighten the structure, and thus contribute to its stability.

The Strand, or *Waterloo* bridge, in London (*fig.* 11), one of the largest bridges in Europe, was begun by Rennie in 1814, and finished in 1817. It is 1200 feet long and 43 feet broad, and consists of nine basket-arches, 112½ feet broad and 28 feet high. To diminish the pressure upon the pillars, all the arches are united by reversed vaults. The pillars are 18½ feet thick, and the heads terminate in the pointed-arch style. Each one bears two columns, whose entablature lies in that of the railing of the bridge.

The bridge of *Colebrookdale* over the Severn (*fig.* 22) is the first great iron bridge, and was the work of the master-smiths John Wilkinson and Abraham Darley. It was cast in 1773 and erected in 1779. It consists of a flat arch 100½ English feet broad and 38 feet high. The arch is formed of five arch ribs; and upon each lies, with the length of the bridge, rows of beams to support the road upon the bridge, which is laid upon iron plates 2½ inches thick, strewn with gravel and sand. Diagonal buttresses and straight joints knit it firmly everywhere. The road upon the bridge is 22 feet broad and the iron works weigh 380 tons.

The most astonishing work of modern times is the tubular iron bridge over the Menai Straits in Wales. This structure will be found mentioned under Technology.

4. GERMANY. The bridge near Kösen over the Saale (*pl.* 60. *fig.* 13) is one of the oldest remaining German bridges, and was built in the 11th century. It is 288 feet long, and consists of eight arches, whose middle five are pointed arches, the rest semicircular. They have 24–25 feet span. The pillars are almost 12 feet thick, and have round heads. The ascent is rather steep.

The Bridge of Zwetau near Torgau (*fig.* 14) was built in 1730 by Augustus II. King of Poland, Elector of Saxony. It is 690 feet long, and has twelve arches in full semicircle, spanning 33–46 feet. The pillars reach to the cornice, and have alternately a three-cornered projection. The bridge is steep and uncertain of ascent.

5. SPAIN. The Bridge of Toledo (*fig.* 21) was built in the 13th century, and is simple and handsome. It is 520 feet long, and has nine semicircular arches of 32 feet span, and eight piers of 20 feet breadth, with semicircular heads which extend to the bridge-way, where they keep the railing firm. The bridge is horizontal.

6. Persia. The Bridge of Barbaruh at Ispahan over the Senderuth (*fig.* 3, the length; *fig.* 4, front view; *fig.* 5, section of the side) is named from its builder, and is of an unknown antiquity. It is 2250 feet long, 120 feet high, and 156 feet broad. The middle way, 60 feet broad, and the side ways are paved with marble, and the latter lead through arcades, to which the ascent is by stairs in the four towers of the bridge. These stairs also lead under the bridge, where a way leads along the length of the bridge through the pillars, as the substructure reaches to the surface of the water, which flows only through bridged canals. The bridge has 29 arches of 50 feet span, and the pillars are 25 feet thick.

7. China. The Chinese bridges have generally huge proportions, as, for instance, the Bridge of Loyang, which is 26,800 feet long, and that of Focheu, which is 22,000 feet long, and both are 60–70 feet wide. We have represented two specimens of Chinese bridges in *figs.* 19 and 20, one with pointed, the other with round arches. These two bridges prove that the usual simplicity of Chinese bridges is not owing to ignorance of the art of vaulting, which on the contrary the Chinese appear to possess in perfection.

MYTHOLOGY AND RELIGIOUS RITES.

Plates VIII. 1–30.

INTRODUCTION.

The belief in a Supreme Power is inherent in every human being; and so thoroughly interwoven with our nature is this sentiment, that it is impossible for any one at any period of life wholly to divest himself of it, and hence the desire to worship this power. Everything in the external world as well as in the internal world of his thoughts impresses him with the great truth, that there is a God who has created all things, and who rules over all. He is forced to this conclusion when looking around for an answer to the questions concerning himself and the material world with which he is surrounded. For what other reply could be given to the questions, "What has called this world into existence? Why does it exist, and what is its ultimate destiny? Nay, why do I exist, and what will become of me after death?" And when his attention is drawn to the phenomena of nature and the extraordinary events in the life of individuals, as well as to the history of whole nations, is he not compelled to acknowledge the superior hand that shapes our destinies, "rough hew them as we may?"

Hence it will be difficult to find among the nations of antiquity or modern times, one wholly destitute of the consciousness that a higher power exists, or without a desire to worship that power in some way or other. Even the Atheist, of whatever school, only deceives himself when he fondly imagines that his reasoning power will always enable him to combat successfully every rising inclination to a religious faith.

But though all nations have acknowledged the existence of this supreme power, they often differ widely in their representations of it, in their modes of worshipping it, and in their habits and thoughts, as far as they are the results of their religious creed. The cause of this difference will be found in the different degrees of civilization, variety of soil, climate, and even occupation, whether commercial or agricultural, peculiar to the country inhabited by each. For in proportion as a nation is barbarous and uncultivated, so will also its religion be rude and imperfect; and the lower its position in the scale of civilization the more incomplete will be the character which it ascribes to its gods; for "As the people's gods so are the people." Hence the many dissimilarities which we meet with by the side of similarities, when comparing the different systems of religion practised by the nations

of antiquity and modern times; and it is for that reason often difficult to show how they are connected in their origin and in the propagation of their doctrines and principles.

The systems of religion best known to us are: Monotheism, viz. the worship of one god, and Polytheism, the adoration of several gods, the latter of which includes also Dualism (the worship of two gods) and Tritheism (the worship of three gods).

The lowest grade of polytheism is Fetishism, viz. that idolatry which teaches its followers to worship inanimate nature, sticks and stones, and the productions of their own skill. Next to this comes Pyrolatry or the worship of fire, and Sabæism, which considers the stars as gods. All other creeds are varieties of the same general system.

Mythology is the name given to the science which treats of the various systems of idolatry, and the doctrines of its votaries. It embraces also the language of figures and symbols by which the ancient and modern Pagans sought to teach their religion, philosophy, and history. Their manner of testifying reverence for the gods, and the other devotional acts appertaining to their religion, are designated as Religious Rites.

Every reflecting man must feel a desire to inquire into and make himself acquainted with these various systems of religion. For, conscious that religion is the most important subject, and of the most vital interest to our race, he will naturally feel inclined to inquire into everything pertaining to it, whether true or false, and to examine the beacons which different portions of our race, at different times, have set up for their religious guidance. This field of human research will present him, like all others, with a view of a slow but constant progress from the imperfect to the perfect. In it he will also learn that notwithstanding all the aberrations of the human mind which have manifested themselves more particularly in systems of religion, there is always a higher power whose overruling influence cannot be mistaken.

It is also impossible, without a thorough inquiry into the migration of religious ideas as they passed from nation to nation, properly to appreciate this progress in the scale of perfection, or to understand the spirit which pervades individual nations in their every-day life, in their heroic deeds, and the vicissitudes that befell them. This inquiry is even necessary to a thorough understanding of the religious systems of our own times.

A knowledge of mythology is also indispensable to explain the growth and spread of the arts and trade, which were indebted to the fostering care of religion for the high degree of perfection to which they attained at so early a period.

We will now endeavor, as far as possible, to pursue a systematic course in tracing the progress of religious development as it is delineated in mythology. To do this we shall have to examine chronologically the various religious systems of antiquity. We begin with those of non-classic antiquity, the more developed religious systems of the Greeks and Romans constituting the subjects of the mythology of classic antiquity.

NON-CLASSIC ANTIQUITY.

I. THE RELIGIOUS SYSTEMS OF INDIA.

1. Mythology and Worship of the Hindoos.

The study of Hindoo Mythology is surrounded with difficulties and obscurities. Many of the books from which we have to draw our information are still either unknown or almost inaccessible to European mythologians. The religious systems have also undergone considerable changes in the course of time, and while some have altogether disappeared, others have taken their place. All this has contributed to perplex many learned investigators, and to cause them to mistake one for another, or to confound them together. Yet, nevertheless, a close examination of the authorities accessible to us will be sufficient to enable us to throw considerable light upon this very intricate subject.

The chief authorities upon which the student of Hindoo mythology must rely are: the four *Vedas*, considered the holy books of the Hindoos; each of which is divided into two parts, the one containing prayers and the other hymns. Next in order are the *Puranas*, eighteen in number. They contain the theogony and cosmogony (doctrines of the origin of the gods and of the world) of the Hindoos. To these may be added the two great epic poems, *Ramayana* and *Mahabharata*, which celebrate heroic acts and battles.

We learn from these holy books that the Hindoo religion was originally a kind of monotheism, for it taught that all was ruled by one great Supreme Being. But it was also at the same time a sort of pantheism, for the Supreme Being was considered to be a portion of the world, a species of world-soul pervading the universe. This monotheism soon degenerated into polytheism, the oldest form of which was *Brahmaism;* it prevailed until *Sivaism* took its place, which again in its turn was supplanted by *Vishnuism.* These systems were named, either after the divinities recognised as the supreme ruler or after their respective founders.

1. Hindoo Cosmogony. The Hindoos have various myths concerning the creation of the world. The simplest is the following. *Brahm* (the self-existing), who is also called *Para Brama* (the infinite), the supreme and invisible god, created the waters at a time when darkness still covered the unfathomable abyss. He then deposited in the waters the seed of light, which soon developed into an egg brilliant with golden hues and sparkling like a bright flame, or as others say, with the combined splendor of a thousand suns. This egg he inhabited a full year (Menus in his book of laws says a thousand years) as Brahma, completely absorbed in self-contemplation. At the expiration of that period he divided it into two equal parts, and then made out of the one half the concave canopy of heaven and the eight celestial spheres, and out of the other the earth and what is called by the myth the water house. These he peopled with gods, spirits, and men, and then became again Brahm.

Another myth describes Brahm (*pl.* 1, *fig.* 1*b*) as the supreme being, self-existing and ever the same, wholly absorbed in his sublime meditations, wrapped in the *Maya* (this word means also delusion), the personification of pleasant self-forgetfulness, represented in the form of a cloak. In conjunction with the Maya (also called *Bhavani*, the mother of all created things), he gave existence to the three great *Deyotas* (created spirits), *Brahma*, *Vishnu*, and *Siva*, who compose the Indian trinity called *Trimurti*, and are represented as a man with one body and three heads (*pl.* 2, *fig.* 1). The Maya, when Bhavani (*pl.* 1, *fig.* 2), is generally found depicted as seated upon a cloud, one foot under her body and the other stretched out as if in the act of descending; a veil cast around her, ornamented with the figures of animals and other created things.

The Trimurti is also included in other symbolical figures of Hindoo Mythology: viz. in the triangle with the flame (*pl.* 1, *fig.* 6), in the *Lingam* or *Phallos* (*fig.* 7), of which we shall speak again hereafter, when treating of Siva. The figure *Om* or *Aum* (*fig.* 9) contains also an allusion to the Trimurti. *Om* is a contraction of the letters A. U. M., and is considered by the Hindoos too holy to be pronounced by any one who is not a Brahmin.

There are a few other symbols which we will enumerate here on account of their connexion with the above. The elephant (*fig.* 8) in the act of worshipping the lingam as the symbol of wisdom; the *Pradyapati* (*fig.* 10) the symbol of creation as taught by the Brahmins; *Pracriti* (*fig.* 11), the symbol of the three divine attributes, the creating, preserving, and destroying powers; and the tortoise upon the serpent supporting the world and the seven celestial spheres (*fig.* 12), as the symbol of eternity. The chief symbol of Brahma is the earth, of Siva fire, and of Vishnu the water; they are all represented in *figs.* 6 and 9.

2. The three Superior Gods. *a. Brahma.* *Brahm*, the Supreme Being, was considered too awful and holy a god to have temples erected to him, or to be addressed by mortals. Hence a distinction was made between Brahm and the spirit of Brahm personified in *Narayana*, which signifies moving on the waters.

Brahma, who was the first manifestation of Brahm enveloped in his Maya, is the embodiment of the creative power and wisdom, as well as the ruler of destiny, and lord over life and death. He is regarded as the first law-giver and teacher of the Hindoos, and hence as the author of the Vedas.

In the sacred book we find the following account of his birth. *Narayana* extended upon the thousand-headed serpent *Sesha*, and moving upon the waters, caused the lotus to spring from his navel, and from the lotus *Brahma* (*pl.* 1, *fig.* 4). Another myth informs us that *Vishnu*, the second person in the Trimurti, and considered by the Vishnuites as only another name for the Supreme Being, assumed as Narayana the shape of a child, with its toe inserted in its mouth, and in this form, bedded on the leaf of the Indian fig tree (*fig.* 1*a*), was rocked by the waves of the milk sea. While in this position, and asleep, he called into existence the laws of

nature, regulating generation, and the result was, that the flower of the lotus came forth from his navel, and gave birth to Brahma the creative power, who in his turn created the world. But a long time, which he spent in profound meditations, elapsed between his own birth and the creation of the world. When he had resolved upon calling the universe into existence, he created first space, and placed in it the seven *Surgs*, or starry spheres of heaven, illuminated by the radiant bodies of the Deyotas. Then he made the earth (*Mirtlock*), and the sun and moon to give it light, and the seven *Patals*, or lower regions. This creation embraced the fourteen worlds of the Hindoo Cosmogony. When these worlds had been completed, and with them the mountain *Calaya* (Meru), there appeared at the top of the latter the symbol *Yoni*, the triangle, and inclosed in it the *Lingam*. Mount Meru was then selected as the seat of the gods, and for that purpose made the most delightful place of abode. Silvery brooks meandered in every direction, and fertilized its soil; magnificent trees, shedding delightful odors and covered with delicious food, gratified the eye and the taste; and four large streams issued from the highest point of the mountain, and flowed towards the four quarters of the heavens. Splendid palaces were everywhere seen, in which dwelt the gods, the guardians of the world, and the souls of the happy admitted to their company.

Brahma, having thus made the material world, now created the spirits; and in order to people his world, he gave existence to one hundred sons, partly *Deyotas*, spiritual beings, to become denizens of the celestial regions, and partly *Daints*, who were to live in the worlds of the lower regions. The earth alone remained still an uninhabited region, but it was not destined to remain so long, for Brahma now resolved to give it inhabitants who should be direct emanations from his own body; and from his mouth came forth the eldest born, *Brehman* (*Brahman*, priest), to whom he confided the four Vedas; from his right arm issued *Chætris*, or *Chetre* (warrior), and from his left, *Shaterani* (the warrior's wife). His right thigh gave birth to *Bais*, or *Bice* (agriculturist and trader), and his left to *Basani*, or *Vaissya*, his wife; and lastly, from his right foot sprang the lowest of the race, *Suder*, or *Sooder* (mechanic and laborer), and from his left *Suderani*, or *Sudra*, his wife.

These four sons of Brahma, so significantly brought into the world, became the fathers of the human race, and heads of their respective castes. They were commanded to regard the four Vedas as containing all the rules of their faith, and all that was necessary to guide them in their religious ceremonies. They were also commanded to take rank in the order of their birth, the Brahmins uppermost, as having sprung from the head of Brahma.

Brahma was originally the first in rank in the Trimurti, but he lost his position very soon after the creation. For the myth tells us that, anxious to enlarge his domain, he secretly appropriated to his own use a large portion of the universe assigned to the other gods, and then claimed, as author of the Vedas, superiority over Vishnu. Besides these, he was also accused of other and more heinous offences. Brahm punished him for these crimes, by casting him, with his place of abode, into the lowest abyss. There he

had to abide for a million years, and to submit to the severest penances, part of which were, his compulsory appearance upon earth during a portion of each of the four ages of the world, in order to act as a chronicler of Vishnu's heroic acts. After that period had expired, he was again admitted into the celestial regions, there to be the representative of the Supreme God. The most prominent of his wives is *Saravadi*, who is described as seated by his side upon an elevated bench (*pl.* 2, *fig.* 15). Brahma is represented as of a golden color, with four heads and faces, with which he looks over the four divisions of the world (sometimes five are given to him); he has also four arms and hands, in one of which he holds the Vedas, in another a sacrificial spoon, in the third a sacrificial vase, and with the fourth he grasps the rosary hanging around his neck. His paradise, *Brahma-Loga*, is upon Mount Meru, the favorite place of the gods. To that place he admits his faithful followers to bathe in the sea *Behra*, by which they renew their youth.

The worship of Brahma has long ago been abandoned by the Hindoos, who now bow before Vishnu and Siva.

b. Vishnu. Vishnu is the second person in the Hindoo Triad, and as the second emanation from Brahm, the personification of the preserving power of that God. His *Avatars* or Incarnations were ten in number, and are the most remarkable incidents in his history and the favorite subjects of Hindoo poetry. In his first Avatar (*Matsyavatara*) he appeared as a fish (*pl.* 2, *fig.* 3). He assumed this form to save King *Satyavrata* or *Vaivasrata* and his queen, with the seven *Rishis* and their wives, during the deluge which inundated the whole earth, for they alone, on account of their piety, were deemed worthy to escape the general destruction. The myth relates further, that he presented them with a vessel (the ark *Cahitra*) in which to navigate the waters, and then transformed himself into a fish of stupendous dimensions, to which the ark was moored, and which served as its guide during the flood.

After the waters had subsided he returned to the land to promote the welfare of the new races. In his second Avatar (*Curmavatara*) he appeared with the body of a tortoise (*fig.* 4). The myth concerning it informs us that the gods and the giants united to prepare the *Amrita*, the draught which gives immortality to all who partake of it; and for that purpose twined the great serpent *Sesha* (sometimes called *Vasky*) around Mount *Mandara* (Mandreghi), and afterwards carried the mountain into the Milk Sea. The mountain was then made to revolve by means of the serpent; for the gods on one side pulled it by the tail, and the giants on the other pulled it by the head in a contrary direction, and thus gave it the rotary motion in order to convert the sea of milk into butter. But after churning thus for a thousand years, they found that the mountain began to settle into the sea. To prevent its further sinking, Vishnu assumed the form of a tortoise, and diving under it supported it on his back till the Amrita was obtained. The gods, who immediately appropriated the precious draught, had to fight a hard battle for it with the giants, who were finally vanquished by Vishnu and then cast into the bottomless pit. But the Amrita was not

the only result of the churning of the ocean. Among other valuable gems *Lakshmi* (also called *Sri*) (*pl.* 1, *fig.* 16), the goddess of beauty and fortune, like another Venus, was born of its foam, and Vishnu, captivated by her charms, made her his wife. In the third Avatar (*Vaharavatara*) Vishnu took upon himself the form of a boar (*pl.* 2, *fig.* 5). This incarnation took place to save the earth from a watery grave; for the giant *Eriniak-Shasser* (*Hirana-Yatsha*, the golden-eyed) had seized the earth and cast himself with it into the depths of the sea. Vishnu, in order to preserve it, descended into the abyss in the shape of a boar, where, after a severe contest, he slew the giant, and then emerged with the earth on the point of his tusks. The earth, however, had lost its balance in consequence of its immersion; he added, therefore, a few mountains of great height to its bulk, and thus restored its equilibrium. In the fourth Avatar (*Narasinghavatara*) Vishnu appears in the form of a man-lion bursting forth from a pillar (*pl.* 1, *fig.* 18), which divided into two parts to give him egress. This incarnation took place in consequence of the blasphemous conduct of the giant *Hirayacasipu.* This giant, who had obtained from Brahma, by means of a long penance, the boon of universal empire, an exemption from death by the hands of either god or man, and that no animal should be permitted to hurt him upon earth, became insolent even to the gods, and caused himself to be worshipped; and when exhorted by his son to abstain from such conduct, he replied by defying Vishnu and all other gods. They were standing before the consecrated pillar erected at the threshold when he exclaimed: "Show me this mighty god and his abode, and I will soon convince thee that he must lie subdued at my feet." Hardly had he uttered these words when the pillar burst asunder, and before him stood the terrible *Navasingha* (the man-lion), who threw himself upon him, and *lifting him off the ground*, tore his bowels out of his body. The fifth Avatar (*Vamanavatara*) is that in which the god appears in the form of a dwarf-brahmin (*pl.* 2, *fig.* 6), who is called *Braman Vimana.* The giant *Bely* had, by the usual process of penances, obtained from the gods such gifts as made him independent of them. He then pursued a behavior similar to that of his predecessors, bidding defiance to the gods. To subdue him Vishnu assumed the form of a dwarf, and while the giant was offering sacrifice, Braman Vimana asked for a spot large enough to build him a cottage on. As soon as this was granted to him he expanded his body to such a degree that it filled the whole world, while he stood with one foot on earth and the other in heaven. Bely, who was at first astonished at the metamorphosis, now recognised Vishnu, and throwing himself down, embraced his foot and begged for pardon; which was granted to him on account of his speedy repentance. His mission during the sixth Avatar was to destroy the giant *Ravana*, King of Ceylon, who had ten heads and twenty arms (*pl.* 1, *fig.* 23). Ravana's offence was that of his predecessors, his having set himself up as an object of worship. Vishnu, under the name of *Parasu Rama*, aided by the king's brother, attacked him, and after a terrible battle slew him with a weapon which Brahma himself had presented to him. He then liberated his wife, Lakshmi, who was incarnate

in the person of *Sita*, and who had been carried off by the Ravana. His exterior during this incarnation is described to be that of a handsome youth of a green complexion, who is armed with bow and arrows (*pl.* 2, *fig.* 7). The *ninth* Avatar is the most important of all his incarnations. He now appears as *Krishna*, the noble black shepherd (*fig.* 10). While he was thus incarnate he was attacked by *Kalinac*, the father of the serpents, who bit him in the heel, and Krishna in return crushed him with his foot. The tenth Avatar (*Katki Avatar*), according to the sacred books, will only take place when the present creation is to be destroyed. When the last day shall have dawned upon this earth, then will Vishnu appear as *Kaninki* or *Katki*, upon his body the head of a horse (*fig.* 12) (other authorities say mounted on a white horse), his right hand armed with the terrible flaming sword, and in his left the impenetrable buckler. The wicked will be judged according to their deeds and condemned to fearful punishment, and the good be admitted into paradise. The sun and moon will lose their light, and the earth tremble to its very centre; the stars will fall from the heavens, and the world with all that is therein be consumed by fire. After that there will be a new heaven and a new earth, and an age of purity will succeed.

Before we close the history of Vishnu we must mention a few other representations of him, frequently met with in the temples devoted to his worship. *Fig.* 9 is that of a beautiful youth seated upon an oval cushion; his head is encircled with the triple crown, to indicate that he is the ruler of heaven, earth, and the sea; suspended from his neck hangs the famous diamond *Kaustubhamanay*, and priceless rubies constitute his earings. Another representation of the god is seen in *pl.* 3, *fig.* 6, which exhibits him as carried by the giant *Garuda*, and in the act of revealing himself to the giant *Vismamitra* and to *Rama* as an incarnation of Rama. He is also sometimes exhibited, as in *pl.* 2, *fig.* 2, completely united with *Siva*, by which some of his followers wish to indicate that Vishnuism and Sivaism are one, and have superseded Brahmaism. Besides these there is a representation of him on a pillar in the palace of Modobedery, near Manglar, where he is seen mounted on the back of an elephant (*fig.* 11) composed of the *gopis* or *gopeas* (nymphs of the Milk Sea).

His paradise is also located on the sacred mount Meru, and is guarded by two dragons. It is divided into four sections, the highest of which is *Nirban*, where the perfectly pure are united with the god, which exempts them from the necessity of a metempsychosis; while the lowest, *Saloc*, is the abode of those who as a reward for their purity in life are endowed with an ethereal body, and with faculties capable of enjoying the purest pleasures.

c. Siva (Shiva, Shiven) is the third person in the Triad. He is symbolized by fire, and is himself the personification of the destroying power. His immediate worshippers look upon him as the Supreme Being, but other sects ascribe to him only a subordinate place. His followers are called Sivaites, and their religious system Sivaism. He is generally represented as of a white color, with *one* head (sometimes with five heads, and with four and in a few instances with sixteen arms) and riding on a white bull. He is distinguished by a third eye placed in the centre of his forehead,

which is the emblem and instrument of his omniscience and omnipotence. *Durga*, the Nemesis of the Hindoos, is said by some to have issued from it. His head is adorned with the crescent and his locks with the *Ganga*, a beautiful female head, symbolizing humidity, one of the fertilizing principles Sometimes, to show the fearful light in which he is viewed, we find him wrapped up in a tiger or elephant skin, a necklace of skulls around his neck, with the trident in one hand and the battle-axe in another. His attributes are the *Lingam*, the trident which never misses the object at which it is thrown, and the snakes which he uses either as a girdle, necklace, or bracelet, or as a toy in his hands. It will not be difficult to recognise some of these attributes in each of the representations which we have given of him. *Pl.* 1, *fig.* 5, represents him as the destroying and reproducing power; this is indicated by the trident in his hands and the flame which rises like a tiara above his head, symbolizing warmth as a fertilizing principle. *Pl.* 2, *fig.* 8, exhibits him simply as a young man seated in Oriental fashion, and holding a long trident in one hand and the Indian sacrificial drum in the other. His wife *Ama*, or *Bhavani*, or *Parvati*, is said to die at the end of every year, when he, in order to honor her, severs one of her legs and adds it to those already hanging on a string around his neck.

Many incarnations, miracles, and heroic labors of Siva are recorded in the Hindoo legends, some of which are illustrated in our plates. The first of these is *pl.* 1, *fig.* 14, where he appears as *Siva Mahadeva* at *Caylasa*, the torrid side of Mount Meru. He is seated upon a tiger-skin, with his back leaning on an oriental cushion; by his side is his wife *Parvati*, evidently pleased with the loving converse of her lord. A little in the rear stands the holy cow, from whose mouth gushes forth the father of waters. Again (*fig.* 17) we see him in the form of *Rudra*, the king of the monkeys. In this capacity and form he showed himself a faithful and valuable auxiliary to Vishnu, during the latter's Avatar as Rama. *Pl.* 2, *fig.* 13, represents him as the hermaphrodite, half man half woman, which is intended to indicate that he and Parvati are so closely united as to make but one person. The name given to him by his followers when he is found in this form is *Parashiva* or *Parasata*. Finally, *fig.* 14 represents him on the back of the giant *Muyelagin*, crushing him, a position which we find explained in the myth wherein the origin and nature of the *Lingam*, the symbol of the triad, and the most important attribute of Siva, is told. This Lingam is also the most sacred symbol under which he is worshipped. It is the symbol of the universe imbued with the powers of the deity, allegorically represented as a column consisting of three component parts: the hardest being Brahma (earth); the second and softer, Vishnu (water and air); and the third and most delicate, Siva (light and fire). These three combined are represented as the fertilizing principle of the earth, and the column therefore appears inserted in the opening of a conch or sea-shell, symbolizing the earth, which rests on a rock symbolizing the durability of its nature (*pl.* 1, *fig.* 7). Siva is represented as the guardian of this column, before which he daily prays and sacrifices flowers, and hence the

Lingam has become his most sacred symbol. It is said to have arisen from a combat for the supremacy between the different elements or principles; and according to the worshippers of Vishnu it originated under the following circumstances.

Certain devotees, who had exhibited extraordinary sanctity, had been granted great powers and privileges on the condition of maintaining spotless purity in themselves and in their families. Siva determined to deprive them of their prerogatives; and with the assistance of Vishnu in the form of a lovely maiden, he succeeded in beguiling them. Smarting under the consequences of their transgression, the poor dupes sought only to revenge themselves upon the authors of their misfortunes. By their prayers and sacrifices they raised up the giant *Muyelagin*, and arming him with the sacrificial fire, sent him to combat Siva; but the god, seizing the fire with his right hand, struck down the giant with the other, and trampled upon his prostrate foe (*pl.* 2, *fig.* 14). Enraged at this failure, the devotees now combined all their incantations, and directed them with terrible effect against their enemy. Enveloped in a volume of unquenchable fire, Siva did not escape without serious injury from the all-searching element, and furious at the indignity, he cast down the glowing fragments of his mutilated body with the full intention of destroying the whole earth by the fire which they would call forth; but Vishnu caught them as they fell, and conveying them into the lap of Brahma, thus saved the world. The wrath of Siva was finally appeased by the promise that the mutilated portions of his immortal body should henceforth, as a symbol of the principle of life or of fertility, become an object of worship to all mankind. *Pl.* 1, *fig.* 7, represents this symbol, or the Lingam. The pedestal, the recipient of the fertilizing principle, is the symbol of Brahma; and the oval cup-like form which it supports, forming the channel of communication, is the emblem of Vishnu, the *Yoni*, sometimes also represented (*fig.* 6) as a triangle. The Lingam is not recognised by the Vishnuites as a sacred symbol, but all other Hindoos worship it with zeal. The principal wife of Siva is *Parvati*. She is described (*fig.* 15) as seated upon a bull with a crescent around her head, and with rays seeking to penetrate the shadow caused by her body, which has reference to the allegory by which the cause of the eclipses is explained. Her name was the Daughter of the Mountain, or mistress of the lofty regions. But different names are sometimes given to her when she is worshipped as the presiding deity over objects.

3. Hindoo Theogony and Theology. Thus far it was impossible to separate these branches from the Cosmogony of the Hindoos, for the gods which we have described were not only the creators to some extent, but also the lawgivers of their creation. But now, having finished the history of the superior gods involved in the creation, we can examine under the proper head the inferior gods and the good and bad spirits of which the theogony treats. The chief among these is *Surya*, *pl.* 1, *fig.* 19, the god of the sun; one of the eight celestial gods or guardians of the world. He is described as standing in a carriage drawn by seven horses, who are guided by *Harun* or *Ariguna*, the god of twilight, with rose-colored reins. The image of the sun crowns

his head, and in each hand he holds a flower of the lotus which opens its petals to the first rays of the sun, and closes them again as soon as the last rays have left the horizon. Among the rest of the inferior gods we must notice *Camadeva* or *Camos* (*pl.* 1, *fig.* 20), the god of love. He is a son of Vishnu and Lakshmi, and is represented as a boy riding a parrot, and armed with a quiver, bow, and arrows. The old Hindoo idols, whose pictures are given in *pl.* 3, *figs.* 1–5, were found in the cave-temples, but their names have as yet not been ascertained; neither have we been able to learn the name or office of the god represented by *fig.* 7, an idol worshipped by the Indians of Astrachan.

The Giants were a wicked race of beings, and since the difficulty about the Amrita, of which they were deprived by the gods, the bitter enemies of the Triad and all its friends. Like *Garuda* (*pl.* 1, *fig.* 22) they are represented with the most grotesque bodies and heads.

House gods, worshipped as the particular patrons of individual families, are also common among the Hindoos. They are generally selected from the inanimate productions of nature; among these the *Ganges*, and other rivers considered sacred, held conspicuous positions. *Fig.* 21 is a specimen of the forms under which they were worshipped. It represents a personification of the *Ganges*, *Jamuna*, and *Saraswadi*, all embodied in one group. Some animals were also considered sacred; among these were the bull, the elephant, the monkey, the eagle, the swine, and the serpent. A trace of this can be detected in the Mythic Camel (*pl.* 2, *fig.* 19). In the vegetable kingdom, the *lotus* was honored as peculiarly favored by the gods. But the Hindoos did not confine themselves in their consecrations and deifications to the productions of our globe; the blue ether above them, with its host of brilliant worlds, was introduced into their religious system. A specimen of this is seen in *fig.* 18, which is a representation of the Hindoo solar system (*Rasi-Chacra*) with the zodiac. *Suraya*, with his phaeton, the only wheel of which is the sun itself, is seen driving through the centre. The back of the carriage leans against Mount Meru, while the remainder, with its seven green horses, is hovering in the air. The inner circle, with its figures, represents the seven planets, in which the sun and moon are included, revolving in their periodical courses. Each of them is named after a god, and has one day in the week assigned to him over which he rules.

The two figures on the left are only imaginary planets; the one with a crowned head resting upon a rug, and supported by a cushion, is intended to represent the ascending node or dragon's head; and the other, the body without a head, seated upon an owl, and holding in one hand a sceptre, and in the other a flower, the descending node or dragon's tail. The myth accounts for these strange figures, by telling us that when Vishnu struck off the head of the giant *Bahu*, whom he had caught taking by stealth the Amrita destined only for the gods, he did it with such force that the head flew into heaven, where it remained, and was placed among the stars. The outer circle of *fig.* 18 is an exact copy of our own zodiac.

The Hindoo worship is much less complicated than the doctrines about

their gods. It is principally confided to the *Brahmins* (*pl.* 3, *fig.* 9), who constitute a caste by themselves, and order, arrange, and conduct every part of it. They alone can become priests; no member of another caste is permitted to read or expound the revelations contained in the Vedas, to prepare the sacrifice, or instruct in religious matters, and, in case of being overtaken by poverty, to demand alms. They are the sole judges in all religious cases, and their decision is considered infallible. They were wont to adorn the temples of the gods with many architectural ornaments. A specimen of these will be found in *pl.* 4, *fig.* 1, which is a correct representation of a pillar, with allegorical figures, found in an old Hindoo temple at Barolli.

Next in importance are the Ascetics. They are generally divided into tribes or fraternities more or less differing from one another in their habits, dress, &c. The most respected and venerated of this class are those distinguished by the name of *Sanashis*, or *Saniassi* (*pl.* 3, *fig.* 10), who are also considered by the people as saints. The majority are Brahmins, and are vowed to poverty, chastity, and abstinence. They lead a wandering life; going from place to place with a staff in one hand, and a cup out of which they drink, in the other, while their dress consists only of a strip of yellow linen wrapt around the body. They abstain carefully from all employment, and obtain the scanty supply of food which they allow themselves by asking it as an alms of their countrymen. Another fraternity of this class, the *Vishnavins* (*fig.* 11), collect their alms by going from house to house with a guitar-like instrument in their hands, upon which they play, and prefer their request in a song; when this is finished, they bow their heads, upon which they carry a small copper vessel to receive the gift which any one may choose to bestow.

The *Penitents* belong also to this order, but are distinguished from other ascetics by their fanaticism. Their gloomy doctrine teaches them to merit reward by a rigid abstinence from all the enjoyments of life, by severe mortification of the body, and a refined self-torment, which cause them to be held in great respect by the people, who look upon them as saints. One of this order is represented in *pl.* 3, *fig.* 12, with a bundle of peacocks' feathers in his arms, his cheeks and tongue pierced with a sharp iron, which is firmly held in its place by another piece fastened under his chin. A whole group of these penitents is given in *pl.* 2, *fig.* 20, where one is seen standing in a painful position on one toe, his right foot and his arms elevated, in which position he has vowed to continue for a specified time. Another is seen stretched out on the ground, in consequence of a vow to measure the distance between two temples by the length of his body, which he does by throwing himself on the ground, and then rising repeats it until he has traversed the space the length of which he is bound to ascertain. The figure on the left of the tree represents one who has voluntarily undertaken to carry a heavy yoke upon his shoulders, and an iron lock in his hands; and the one in the left corner does penance by carrying heavy weights in his hands and around his neck; while he who is seen in the back-ground, between these two, has resolved to remain for a definite

period in a fixed position, his leg chained to the ground, and his eyes fixed upon the tip of his nose, with his mind wholly absorbed in meditations. Many other and often fearful penances are voluntarily submitted to by these deluded followers of an idolatrous creed.

Like all other nations of antiquity, the Hindoos considered sacrificial offerings one of the most important parts of their worship. The value and the kind of these were in many instances prescribed by the priests, who selected the utensils, a representation of which will be found (*pl.* 2, *figs.* 21–24), for the ceremony, according to the nature of the offering.

Strong were the barriers thrown out by the founders of Brahmaism to guard against division or innovations; but notwithstanding all these precautions, there sprang up, as we have said, different sects, who disagreed about essential doctrines. The most important schism, however, was that which was known as Buddhism.

2. The Religion of Buddha, or Buddhism.

This religious system does not profess to be a new religion, it only claims to be a reformation of Brahmaism, which having become corrupted it sought to exhibit again in its pristine purity. The history of its founder, *Buddha*, is still enveloped in much mystery. Some assert him to be one of the seven planets, the one who rules the fourth day of the week and who is called by the Hindoos *Buddha-Vara;* others consider him to be Brahma himself; while a third party look upon him as the ninth incarnation of Vishnu, and hence *Krishna* only under another name. Some of the learned among his followers say that he was the saint known also as *Sacya*, while the Hindoo transcendentalists contend that Buddha is not the name of an individual, but only a word used to signify a certain assemblage of virtues, or the character of a perfectly virtuous being.

Hence the various accounts given of his birth and life, and the different representations made of him. In his character as a sage and the first teacher of the sublime sciences he is sometimes found as *Surya* (*fig.* 17) with seven heads on one body seated in an oriental fashion and with his eyes turned in every direction; on his breast and in his open hand is the square, divided into four smaller squares, and at his feet the crescent moon. He is also represented in a similar position, with but one head and without the square on his breast or the moon at his feet as in *fig.* 16. A more magnificent representation of him is sometimes found in which he is surrounded, as in *pl.* 3, *fig.* 8, with figures of men and animals, all in the act of worshipping him. What we have said here will explain why he is worshipped by his followers under so many different names. But all agree in recognising him as the supreme ruler of the present age of the world.

Buddhism flourished for a long time in Hindostan proper until *Dhurandara* put to death *Aditya*, the last Buddhist king, and compelled his followers to seek refuge in other kingdoms. They then emigrated into the country of the Burmese, into Further India, China, Siam, Thibet, Mongolia,

Tartary, and many other countries of Asia. Thither they carried their religion, and propagated it with such success that it has continued even up to the present time the prevailing religion of these countries. Much of this success is owing to the policy which they pursued at the very outset, not to set their religion up in opposition to that which they found in each of these respective countries, but to graft it upon the already existing form of worship. Thus among the nations of Northern Asia they identified Buddhism with the prevailing doctrines of *Zoroaster*, while their brothers in other countries hesitated not to incorporate the most opposite doctrines in their creed, provided they could thereby persuade the nation which granted them an asylum to adopt also their religion. We need not, therefore, wonder at the many diversified sects and doctrines to be found under the general name of Buddhism.

The most marked features by which it distinguishes itself from Brahmaism are: that it rejects a distinction of castes, while it acknowledges the right of all to serve God as it may seem best to them (hence, also, the right of every one, no matter what his birth or condition in life, to become a priest if he chooses), and the abolition of all bloody sacrifices, for it deems only those offerings acceptable to the deity that can be made without giving pain to any living creature. As an indication of the latter, we find the statues of Buddha distinguished by a flower which he holds in his hand, which is interpreted to be an allusion to that golden age of the Hindoos when the Vedas and the bloody sacrifices commanded by them were as yet unknown, and man was wont to bring as an acceptable offering to the gods, the fruits of the earth and the flowers of the field.

The doctrines of Buddha are too little known to attempt a full exposition of them; only an outline can be given with anything like accuracy. The Buddhists teach that in the beginning there was only an infinite vacuum, in which creation, destruction, and restoration (*Loga*) developed themselves. Gradually there appeared the seed of good and evil; the former found its reward in the highest condition of bliss, while the latter met with its punishment in a succession of innumerable births through which it was compelled to pass, which, when completed, were divided into six departments or degrees. The first of these is the kingdom of the pure spirits, *Esruen* or *Tœgri*, over which *Chormusda* rules; the second, that of the bad or impure spirits, *Assuri*, under the government of *Bimatchi Dahri;* the third, that of men; then comes that of the animals, that of the monsters in the portals of the infernal regions, and finally that of the inhabitants of hell itself. These kingdoms were also subdivided into minor sections, through which all created beings have to pass during their state of impurity until the time of their final reunion in one great being. The final and highest state of existence is that in the *Buddha* or *Burchan* state. To hasten the coming of this period Buddha descended upon the earth, and by his efforts he will raise all men and spirits up to that degree. Though millions of years will have to pass until this great work will be accomplished, it will finally terminate in the absorption of all, Buddha included, in one grand unity, the end of all things.

1. The Spirit World of the Buddhists. The celestial beings who are called *Nat*, are divided into three classes, and these are above the twenty-six heavens, which run parallel with the earth and are of the same size. The lowest of these is 130,000 miles above the earth, in the centre of Mount *Mienmo.* It is adorned by the sun, moon, and stars, and inhabited by the *Nat Zatamaharit* who dwell in four kingdoms, each of which has its separate capital and king. The highest part of the mountain constitutes the heaven of the *Tavateinza*, who are of immense size and enjoy twice as much felicity as the Nat Zatamaharit. Their immediate ruler is Buddha under the name of *Sacreiya.* Then come the other heavens, one still above the other, and each conferring in its turn double the happiness and duration of life enjoyed in the heaven next below. Good men ascend first to the lowest heaven, with the prospect of being advanced by degrees to the very highest.

But even these heavens were not always free from sin, for a portion of the Tavateinza, seduced by the wine as it pearled in the cup, partook of it and became *Assuri*, in consequence of which they were banished from their heaven. They wandered for a time in the empty space until Buddha created for them a new world beneath Mount Mienmo, where they were permitted to live and enjoy a species of inferior felicity. They were also made the judges over the souls of those recently deceased, and are therefore located near the portals of *Niria*, the hell of Buddhism.

2. Moral Code of Buddhism. The moral code is mainly embraced in five great commandments: 1. Thou shalt not kill. 2. Thou shalt not steal. 3. Thou shalt not covet thy neighbor's wife. 4. Thou shalt not lie. 5. Thou shalt not drink wine or any other intoxicating liquor.

Besides these, the great commandments as they are called, Buddhists are enjoined not to use harsh or angry words and idle conversation, not to covet their neighbor's goods, not to wish a neighbor's misfortune or death, and carefully to abstain from every act or thought which may lead them to worship false gods.

3. Sects among the Buddhists. We have already stated the causes which led the followers of Buddha to divide into numerous sects. These sects in the progress of time began to differ widely from one another, not only in their names but also in doctrines and rites. Our space permits us to allude only to a few.

One of these is the sect called *Tensjû.* It has its chief temple at Foocoosaizi, of which we have copied an interior view (*pl.* 4, *fig.* 17). *Pl.* 6, *fig.* 4, represents the chief priest; *fig.* 5, one of the subordinate priests. The former is particularly distinguished from other priests by the rich necklace, a drawing of which is given in *figs.* 16 *a b*, 17 *a b*. Another sect, the *Hokkesjû*, worshipped in the temple of *Nitsirin* at Honrensi (*pl.* 4, *fig.* 16). *Pl.* 6, *fig.* 8, is the figure of a priest belonging to this sect. *Fig.* 7 is a priest of the *Iccosjû*, and *pl.* 5, *figs.* 39, 40, priests of the sects *Zen* and *Singon.* All the temples were supplied with various implements that were used in the service and when offerings were made: some of these we have represented on *pl.* 1, *figs.* 25–28, and *pl.* 4, *figs.* 18–32.

A beautiful and rich altar-piece is given on *pl.* 1, *fig.* 24. Many of the figures and attitudes in it recall to mind the pictures of the Virgin Mary with the infant Saviour in her arms, and the three Magi.

Before we leave this subject, we must not forget to mention more particularly the votive tablets, *pl.* 4, *figs.* 33–36. They had their origin in a custom which was also not unknown to the Greeks and Romans, that of making vows on extraordinary occasions: for instance, in case of sickness, for the recovery of the patient; or when travelling, for a safe return home; and in order to remember such vow, they wrote it upon a tablet, which they wore suspended around the neck until it was paid. Hence the name, from the Latin, *tabulæ votivæ.*

After having thus touched upon all the most important points of Buddhism in general, we will now examine it in one of its special forms, Lamaism.

3. Lamaism.

Lamaism is one of the many religions under which Buddhism disguised itself, when it entered as a refugee the territories of those who gave it shelter. It derives its name from *Lama*, the title which the Thibetans, Mongolians, Tartars, and their kindred nations gave to their priests. They worshipped Buddha (considered by them the ninth incarnation of Vishnu) under the name of *Shakia-muni*, the supreme being, ruler of all things. The inferior gods held in great veneration by them were *Dshaed-shik*, who introduced Buddhism into Thibet, and *Cenresi* and *Cadroma*, two apes who were held to have been the first parents of the Thibetans. *Pl.* 3, *fig.* 19, exhibits another of their idols called *Amida.* It is generally found with a head like that of a dog, seated on a throne, its feet planted on the back of a lion, who stands upon a corpse. Among the goddesses they assign the highest rank to *Purha* (*fig.* 14). She is always represented as a woman; one of the family of gods (*Pusa*), to which was assigned the guardianship of the minor affairs of life, and the members of which were interrogated as oracles in all ordinary transactions. It is very probable that this goddess was only a personification of nature, and hence we find her represented in different ways. Sometimes partially, at other times wholly dressed, she is seated upon the *Musnud*, a seat in the shape of an altar, and formed of several cushions laid one upon another, generally from five to seven feet high; her legs are crossed, and her neck and breast ornamented with a rosary. The cuticle of the palms of her hands and the soles of her feet is slit open in a circular or star-like form, and that of the nose in straight lines.

They had also a number of other gods of less importance, a few of which are represented by *figs.* 13, 15, 16, 17, 18, and 20, whose names and characters have not yet been learned.

The spiritual world of Lamaism embraced also a great many good and bad spirits: among the latter we mention the *Assuri*, who were divided into four sections, each governed by its own prince.

1. Cosmogony. Lamaism had also its own peculiar cosmogony. It teaches its followers that incessant rains formed the ocean, which became agitated by a violent storm; and after this subsided a golden bottom was found to support the waters, from which four different species of atoms evolved, which when united constituted the world. After thus being called into existence, it was divided into four equal parts and eight islands. The central part of the world is occupied by the *Righiel* or world-mountain, supporting the *Summar Oola* or world's pillar. The country north of this mountain, *Enada Mina*, is inhabited by a race of beings without a soul, but enjoying a very long life. The solid part of the earth was then encircled by the briny ocean, and this again by an iron wall. This world being thus prepared to receive its inhabitants, the *Lahen* spirits sent by the Supreme Being descended from on high and clothed themselves with earthly bodies, which shone with a lustre which enabled them to dispense with any other light. Their food was the fruit of the heaven-born tree *Zampu* planted for them, and from whose sides gushed the four sacred streams, *Gangi*, *Sinthu*, *Pankin, and Sita.* They lived thus in happiness and innocence for 80,000 years, until they yielded to the tempter and partook of the forbidden fruits of *Shima*, the earth, when they lost their inherent luminous radiance, and were hence buried in profound darkness. To disperse this darkness the great being caused the sun, moon, and stars (planets who derived light from their inhabitants, Lahen, in their primitive state of innocence) to appear in the sky. The fallen Lahen wandered for a while upon the earth, now cursed on their account, and then died without heirs. Those who had repented were transferred to other worlds, while the others had to expiate their sins by being sent into the bodies of animals and reptiles. After the first race had wholly passed away, the supreme being sent other Lahen, to some of which he gave the bodies of men and to others those of beasts. But only two of these new inhabitants of the earth had the power of assuming different sexes, and that only on condition that while so doing they must divest themselves of the form of man, which was the image of the celestial beings. *Cenresi* and *Cadroma* assumed therefore the shape of apes, as that most resembling the original form of man, and in that shape became the progenitors of the human race. Man now began very soon to degenerate and display the lowest vices of a fallen being, which contributed greatly to reduce gradually the original period of his longevity (30,000 years) to that of a hundred years, and this will continue to decrease on account of his hardness of heart, until ten years will be the average lifetime and an ell the average size of man.

2. The Condition of the Soul after Death. Lamaism teaches that as soon as death has separated the soul from the body, the former has to appear before *Erlik-Khan*, the judge of the dead and the ruler of the lower world, by whom it is judged according to the deeds done in the body. The good are then sent to the paradise (*Tanghri*) of the happy, where silver trees bearing golden and diamond fruits gratify the eye, and where unceasing pleasures await those who have lived a good life. There is also a second though inferior paradise, for those who have not attained to so great a per-

fection as to merit admission into the first. But only few are so perfect as to be immediately assigned a place in either of these abodes; most men have to undergo first a purification, shorter or longer according to the state of the soul, by means of a transmigration into the bodies of different animals, which always terminates in the body of a dog, the emblem of fidelity and genius, before the soul is permitted to inhabit for a second time, preparatory to its final rest, the body of a human being.

The wicked are condemned either to a long course of transmigration from one body to another, and if very bad through those of the meanest reptiles, or if hopelessly corrupt are sent to the lower regions (*Tamu*). Tamu is divided into three regions: the first, *Biridien Orron*, is a kind of purgatory, whence the soul after a long course of suffering may again be liberated. This purgatory is situated 500 miles beneath the surface of the earth, and has a large city, surrounded with white walls, for its capital, in which Erlik-Khan has his palace in a castle guarded by sixteen iron walls. The second division in Tamu is *Giehva* (hell), subdivided into sixteen regions, eight of which are always filled with a burning heat, and in the other eight reigns more than polar cold. In the former the spirits are tormented by being thrown into vast caldrons filled with liquid iron, and then stirred up in their frightful bath by their jailors, the imps of the place, while others are hacked or cut to pieces with red-hot saws and scythes. In the other division a fearful cold penetrates every sensitive part, without depriving it of sensation. Murderers were thrown into the boiling ocean of ever sweltering gore. The soul that had once entered these regions could never more return.

3. The Priesthood. Priests have always exercised a great influence, and Thibet may justly be called the kingdom of priests. Those of the higher rank are called *Lamas*, and those of the lower *Gylongs*. The former are always considered an incarnation of the gods, and are therefore always looked up to with the most profound reverence. *Pl.* 3, *fig.* 21, represents a Mongolian Lama, and *fig.* 22 a Lama among the Tartars. The chiefs of the whole priesthood, and at the same time the rulers of the country, are two *Great-Lamas*. One of these, the *Dalai Lama*, resides at Lassa and governs the northeastern portion of Thibet; the other, *Bogdo-Lama*, has his residence in Tishi Lumbo, and exercises dominion over the southern part of Thibet. Besides these two there is also a *Great-Lamaess* (female Lama), who resides on and rules over the island Palte or Shandro, governing the convents of this island. But though absolute on the island, she is not independent of the Great Dalai Lama, before whom she appears at stated periods seated upon a movable throne, her face and body enveloped in costly veils, and her carriage surrounded by a numerous retinue.

The Dalai Lama is considered not only the representative of the Supreme Being, but also the Deity itself incarnate and dwelling upon earth. Hence divine honors are paid to him, which he receives seated with crossed legs upon a magnificent cushion of costly material and embroidered with gold and precious stones. He is supposed to be omniscient and omnipresent, and on that account the questions which he addresses to his worshippers are

considered only tests to ascertain their sincerity and truth. His death is only the destruction of the external form, subject to the unchangeable laws of matter, which the undying principle has left to inhabit another body. His corpse is then burned with imposing ceremonies (*pl.* 3, *fig.* 23). It becomes now the duty of the Lamas to discover the person upon whom the spirit of the Dalai Lama has descended, and in this search they have no other guide than the name of the province in which he resides, which has been designated by their late chief, and certain signs and tokens known only to themselves. We have already said that Thibet may justly be called the country of priests; hence comes it that an unusual proportion of the inhabitants belongs to that order, which is divided into nine degrees.

The two Great-Lamas are always surrounded by a long retinue of priests belonging to the first order, and it is said that in and around Lassa there are 30,000 persons belonging to the different degrees of priesthood. The country is moreover filled with numerous monasteries and nunneries, the greater number of which are in the hands of the Lamas. There is not a family in the land which has not at least one of its members enrolled as a priest, monk, or nun.

The worship of the followers of Lamaism consists chiefly in the consecrating of persons to the service of their religion, in prayer, singing, and performing upon musical instruments; though even the giving of presents to the Lamas is considered an act of divine service. They have also several religious festivals and processions; as one of the former, we mention the celebration of the new year, which takes place in the beginning of February.

The *Mongols* who profess Lamaism differ from their neighbors, the Thibetans, only in the more rational and less idolatrous respect which they pay to the chief of their priesthood, whom they call *Cutuchtu.*

On *pl.* 2, *figs.* 25–30, will be found some ancient idols worshipped by the Mongols; but little is known of their history and to what system of religion they belonged.

4. Chinese Mythology.

We have classed the Chinese religious systems under Hindoo Mythology because their most common religion (Foism) is properly only a variation of Buddhism.

The most perfect religious toleration is practised in China, from which only Christians and Mahomedans are excluded; hence we find three forms of religion among the inhabitants: that of *Lao-Tse*, or *Laokiun*, or *Laokung;* that of *Confucius*, or *Chung-Tse;* and that of *Buddha*, or *Fo.*

The primitive religion of the Chinese was in a great degree a worship of nature. *Tian*, who represented the heavens, was their chief deity. Next to him in rank were the spirits who ruled the earth, the stars, the mountains, cities, and rivers; and next to these the souls of their ancestors, particularly those of the Emperors, all of which received divine honors.

The first reformer of this simple religion, particularly of the moral precepts connected with it, was Lao Tse, or, as he is sometimes called, Laokung. He was the son of a poor peasant, but was already at an early period of his life fond of meditating and speculating upon religious subjects. During a journey to Thibet he became acquainted with Lamaism, which was then already the religion of that country, and pleased with many of its features he resolved to introduce them among his own countrymen.

As the basis of his moral system he laid down the rule that man must subdue and control his passions if he wishes to obtain spiritual and physical happiness. But he asserted also at the same time that sickness and death, the two greatest enemies to undisturbed pleasure, could and ought to be overcome by the draught of immortality (a preparation of opium and other materials calculated to excite the nerves) lately discovered.

The temples of his followers are filled with large uncouth idols made of wood, stone, or burned clay, and painted or varnished with glaring colors. A favorite idol with them is the so-called god of immortality (*pl.* 4, *fig.* 2). The manner in which they arrange their idols is peculiar to themselves. It is done by placing on one side all those that personify virtuous and proper sentiments with their corresponding antagonists opposite to them; thus the personification of love is contrasted with that of hatred.

This whole system of moral philosophy was Epicurean in the lowest sense: Let us eat and drink, for to-morrow we die. The priests of Lao-Tse, in accordance with his precepts to enjoy the present without a thought for the future, lived in celibacy and associated together in convents, where they practised magical rites, incantations, and the invocation of spirits.

The professors of this creed are chiefly the rich, and those that belong to the higher classes of society. But Lao-Tse, the founder of this sect, met already during his lifetime with a rival.

Chung-Tse, or, as he is commonly called, Confucius, came also forward as a reformer, with the avowed purpose to re-establish again the religion of the fathers, and to lead man back to a primitive life of purity and virtue. His object was not so much to teach a new religion as the inculcation of moral principles, and to induce his countrymen to live a moral life.

The Mythology which he taught was, that from the Great First Source, *Taiki*, emanated *Yang* and *Yen*. The former, which was the perfect principle, was of the masculine gender, and included the higher heavens, the sun, day, and warmth; and the latter, the imperfect principle, and of the feminine gender, comprised the moon, the earth, night, and cold. From a union of these two sprang the lower heaven (the sky) the source of moisture, fire, water, the winds, thunder; the dry land, and mountains.

Man was then formed of an ethereal principle, which was joined to an earthly heavy body. The two are again separated by death, which consigns the latter to its mother earth, and permits the former to fly back to its native element. But the spirits of the good are not cut off by this return to a spiritual abode from visiting the places where they dwelt while upon earth, and particularly the spots where divine honors are paid to them by their descendants, upon whom they are permitted to bestow blessings and favors.

Confucius attached no idea of personality to the Deity, and prohibited his followers from making images or representations of him; and seems to have worshipped him rather as a power or principle pervading all nature, and acting by means of his creatures the sun, the moon, and the elements. To these he ordered adoration to be paid, joining them all in one under the name *Tien* (heaven).

As a teacher of morals he was in advance of his age and country. The main features of his moral code were: love all mankind, execute justice, be upright in all dealings with men, and observe the laws and customs sanctioned by the authorities.

His disciples, who were chiefly the nobles and the educated, revered him therefore as a saint.

Buddhism, which we have shown to be the foundation of Lamaism, was also the basis upon which the religion *Fo* is built. But here the original assumed a far more varied and amplified form than with the followers of Lama.

This system of religion has the greatest number of professors in China. Many of the doctrines of Confucius and the ancient Chinese have been incorporated in it, while the features which it has borrowed from Lamaism served to degrade it into a common idolatry.

But it is the religion of the emperor and of the people. Many if not most of the Chinese idols are little more than adaptations of Indian deities, or the persons of their remote ancestors invested with the characteristics of these gods. *Pl.* 4, *fig.* 3, represents one of these, *Tshing-Hoang*, receiving the offerings of his worshippers, and *fig.* 4 another, *Totur*, or as he is sometimes called *Ninifo.*

The priests, who are very numerous, are called *Bonzes*, and are divided into different classes. They inhabit convents called *Poo-ta-la.* This word is derived from Buddhalaga (the dwelling of Buddha), the Chinese not being able to pronounce the original word. In *fig.* 6 we give a representation of some priests in the dresses belonging to their respective ranks. The chief priest is here called *Bandshiin Erdeni*, and like the Dalai Lama is absolute head of the priesthood throughout the empire. The priests of the higher classes are educated, and in duty bound constantly to study their religious books; but the lower classes are very ignorant, and live in convents, where they pass their time in modest retirement, fasting, and penitential exercises. Foism has also its female Bonzes, who live together in convents like nuns.

The temples dedicated to the worship of the idols are either mere chapels, being areas inclosed by colonnades, at one end of which is an apartment called *Ting* for the idol; or they are large temples, consisting of several such inclosures, the whole surrounded by one colonnade, ornamented at the corners with pavilions two stories high, and surmounted by high towers. These temples always contain several idols, each of which has its own apartment in it.

The worship of the Foists consists mainly of prayer, music, and offerings. *Pl.* 5, *fig.* 1, represents the interior of the temple of Fo in Canton during worship; *pl.* 4, *fig.* 5, the worship in the temple at Honan near Canton;

and *pl.* 11, *fig.* 20, represents the interior of a temple in which the *Toku-Nafir* is worshipped with strange ceremonies. Religious festivals and processions are very numerous; especially in July and August, the dry season in China, when these solemn trains may be seen in every province, invoking the gods for a plentiful rain (*pl.* 6, *fig.* 9).

The religion of this idolatrous people abounds like that of other nations of antiquity in superstitious rites; one of these, the inquiry into the future, is illustrated on *pl.* 6, *fig.* 10. The figures to the left represent a Chinese with his friend who, about to enter upon some important undertaking, as marriage, the building of a house, or a distant journey, seeks first one of those little temples which abound in every city and village, and are even to be found in the forest and on the mountain top. They are always open in order to enable any one to repair there and seek counsel. The inquirer having entered approaches the altar before the hideous idol, and takes the cup with the little wooden sticks; this he shakes until one of these staves falls out, and is carefully examined on both ends upon which different words are inscribed. The priest seated to the right now endeavors to find in the book of divination (which is always kept in the temple) the corresponding sign and its interpretation. This ceremony the inquirer repeats three times, and if he meets with one favorable stick during the process, he considers it a propitious omen. His friend behind him looks on with anxiety vividly depicted on his countenance. If the enterprise turns out favorably, the grateful worshipper returns to the temple and acknowledges his indebtedness by burning a few sheets of colored paper upon the furnace which is seen to the right of the idol, and then deposits a few coppers for the support of the temple.

5. Japanese Mythology.

The Japanese, whose religious systems are classed here for the same reason as those of the Chinese, namely, on account of the prominence of Buddhism, enjoy like the Chinese great religious toleration. Hence the variety of different creeds professed not only by different families, but also frequently by the different members of the same household.

The oldest religion of the island, and that which would be still the prevailing and state religion if political causes had not obliged many of the inhabitants openly to acknowledge one of the sects of Buddha, is the *Xinto* or *Sinto* religion.

This system teaches the existence of a supreme invisible being inhabiting the infinite regions of eternity, and that of a race of great but inferior gods who dwell in the visible heavens.

But the great king is thought of too lofty a nature to be represented by images or worshipped in temples, while the other gods are considered as wholly indifferent to all the affairs of man. No altars are therefore erected to either, nor religious worship paid to them. Their existence is only recognised as objects by which to swear. The gods that are worshipped by the

people are a kind of inferior deities, called *Cama*, who are represented as the rulers of the world and the destiny of mankind, and whose altars are zealously thronged with supplicants.

The chief of the priesthood, *Dairi*, is also deemed to become a god after his death; hence the number of their gods increases from time to time. Pious men are after their decease adored as saints.

The creation of the world had, according to the Sinto religion, its origin in a wandering chaos, which gave birth to the spirit of the universe, *Ki* (power). This Ki then created out of the chaos seven races of sensuous spirits. The first of these was *Tensjo-Dai-Sin*, the creator of Japan. From him emanated the succeeding spirits, who decreased in spirituality in the order in which they came forth. The people over which they ruled were of a semi-divine nature, but gradually degenerated, until they sank to the level of the present race of men.

According to the views of the Japanese, the soul immediately after its separation from the body is cited before a tribunal where it is judged for its motives as well as for its deeds. The just are then recompensed by an immediate admission into the thirty-third or highest heaven, but the wicked are excluded, and condemned to wander about in space as a punishment for their sinful life upon earth.

The duties to be performed by the pious are: to cultivate purity of thought and the practice of strict morality, symbolized by great purity of the body, to celebrate the days set aside for festivals and religious services in the temple, pilgrimage to the sacred place *Isje*, and mortifications of the body.

The temples, *Mias*, generally consist of two apartments, a large one for the accommodation of the priests and their attendants, and a small chapel for the idol. Their erection is required to be accomplished without injury to any of the laborers during the progress of the work. On *pl.* 5, *fig.* 11, we give a representation of one of these chapels, that of the *Cami of Givon*, in which the little building on the top, 1, is the mia of the two Cami; the building, 2, the mia of the two *Inari* (*figs.* 12 and 13); the building, 3, is the house for the priests; and the square to the right, 4, the place for music and dancing. *Figs.* 14, 15, 16, and 17, are the four *Camini*, who are always represented as watch-dogs. *Fig.* 4 shows the interior of the temple of *Miroc of Tuku-Kaisi*, one of the four great gods of the Sinto religion. He is worshipped (particularly by merchants) as the god of riches, health, and happiness, and always represented very corpulent.

The title of the high priest (*pl.* 6, *fig.* 6) is *Ninxit*, who is second only to the great Dairi. All the priests of the second class (*Tondas*) are chosen by him.

The Buddhist form of worship, which comes next to that of the Sinto, and is often called by the natives *Buddsdo*, has the greatest number of professors. The leading doctrines of this system are: that *Amida*, or *O-mit-to*, the creator and supreme ruler of the whole universe, is without beginning or end. He at one period came down upon earth, where he lived for a thousand years and became the redeemer of our fallen race.

The good who keep his commandments, will through him obtain forgiveness of sin and life everlasting; but the wicked will be cast into hell for a time proportioned to their sins. After a suitable expiation has been made, Amida's mediation will procure for them permission to return to the earth, to inhabit first the body of some animal and then that of a human being, and thus to have an opportunity to secure for themselves, by a more virtuous life, a happier fate in the land of spirits.

The sect of *Syuntoo*, which professes the morality of Confucius, is quite distinct from the above creeds, and numbers among its adherents chiefly the great and the learned. Here, as in China, its only object is the inculcation of a virtuous life in this world, without any reference to a future; for it teaches that the soul of the departed is absorbed into the all-pervading power, as a drop of water into the ocean. It teaches also that the original ruler of the universe, but who was not its creator, is a spiritual and perfect being, and the world which he governs eternal. Men and animals are the productions of *In-Jo* and the five elements. The professors of this creed have no temples or ceremonial worship; they only celebrate the days set apart for the commemoration of their departed friends and relations.

When we take into consideration the different religious creeds of Japan, with their diversity of doctrines and traditions, and the manner in which new gods are added to their list, it will not appear strange to find that a host of idols are worshipped there. There are not less than 3,132 Cami enumerated; 492 of these were created spirits, and 2,640 are canonized mortals. Besides those mentioned already before, we will only add here the following: *Syu-took-dai-si* (*pl.* 5, *fig.* 2), and *Koobo-dai-si* (*fig.* 3); the idols of *Mumero-maro* and *Matsvo-maro* (*fig.* 5); *Cami Tenzin* (*fig.* 6); *Tsyoo-bon-ge-syoo* (*fig.* 7); *Tsyoo-bon-tsyoo-syoo* (*fig.* 8); and *Kong-goo-kaino-dai-nitsi* (*fig.* 9). The idols chiefly selected as objects of worship in the temples are: *Man-da-rano-mida* (*pl.* 4, *fig.* 7); *Hookai-syooye-yuge-tsintsua* (*fig.* 8); *Kokuuzoo-basats* (*fig.* 9); *Sitsi-tsi-montsyoo* (*fig.* 10); *Ye-kwan-soo-tsyoo* (*fig.* 11); *Tsen-mui* (*fig.* 12); *Hoo-syoo-ni-yorai* (*fig.* 13); *figs.* 14 and 15 are only house-gods, idols worshipped in domestic circles by particular families. A few other idols will be found on *pl.* 6, viz. *fig.* 1, *Tsigo-montsyoo: fig.* 2, *Itsi-tsi-kin-lin;* and *fig.* 3, another whose name has not been ascertained.

To avoid the confusion that must necessarily attend the worship of so great and diversified a number of idols, and to give to each his share of worship, they have been divided into sections, and one or several assigned to each province and district in the empire.

The great diversity with which these different idols are worshipped in their respective temples, requires also a great number of vessels and instruments, each appropriated to its own particular use. Among these are censers (*pl.* 5, *figs.* 18, 19, and 20 *a b*); vases for flowers (*figs.* 21, 22, and 23); ornamented candlesticks, used only at ceremonies in the temples (*figs.* 24–27); various utensils employed during the service (*figs.* 28–34); and musical instruments (*figs.* 35 and 36). *Pl.* 6, *figs.* 12 and 13, are some other vases, and *figs.* 14 and 15 other utensils belonging to the service of

the idols. As in China, so also in Japan, processions constitute an important feature in the celebration of religious festivals (*pl.* 6, *fig.* 11).

We have already mentioned a few of the religious societies when we were treating of idolatry in China; we will therefore only add, since the same features are also found in this country, that Japan is also not without its monks and nuns, a few of which we have represented on *pl.* 5. *Fig.* 37 is a *Jamabusi*, or mountain monk of Japan; *fig.* 38, another, with the idol-box upon his shoulders, with which he wanders from place to place: *fig.* 41 a blind monk, and *fig.* 42 a nun and a lay sister.

6. Javanese Mythology.

Sivaism seems to have constituted the primitive feature in the creed of the aborigines of the island of Java; only at a later period was Buddhism intermixed with it, but the whole was subjected to many reforms, and many centuries elapsed before the latter system became the prevailing religion. At the present time, most of the inhabitants are Mahomedans, though Christianity is not wholly unknown in the island. But though the Javanese profess now a belief in one God, they are by no means free from superstitious practices, which bear evidently the marks of being remnants of the idolatry of their forefathers. A few of the idols of the olden times are still found in several places of the island, pictures of which will be found on *pl.* 6. *Fig.* 18 represents *Ganesa*, a son of Siva, with the head of an elephant, whom the Indians worshipped as the god of marriage. *Fig.* 19 is probably intended for the Trimurti, with Siva as its chief, and (*fig.* 20 *a b*) *Siva* himself, in his character as the destroyer, having around his neck the string of skulls. *Figs.* 21, 22, and 23 are evidently not idols of Indian origin, and must have come from some foreign quarter; their import has not yet been ascertained.

II. THE RELIGION OF THE ANCIENT PERSIANS.

(PARSEEISM.)

This religious system differs essentially from those already described, and has even a faint resemblance to the Mosaic and Christian religions.

The primitive religion of the ancient Persians was simply a worship of the elements of nature, fire, water, earth, and air, the winds and the starry heavens, but particular reverence was paid to the sun and the moon. The rivers were also considered sacred. They had no temples, but sacrificed upon the mountains, by offering to the gods the lives of animals without burning their bodies. It is probable that, already at an early period, the principles of a religious system which came out of Media were incorporated into this service of nature, and became soon after the prevailing religion.

Such was, in all probability, the origin of the *Magian*, or Medo-Persian religion.

The first framer of a new law was *Hom*, who is also generally considered to have been the founder of the sect known as *Magi*, and who continued on that account to be held in high esteem. At a later period *Zerdusht*, or *Zoroaster*, reformed and renovated the religion of the Persians, and wrote for them the book which contained the law, and which is still in existence. The life, and even the epoch of the birth of this famous legislator and reformer, are involved in the utmost obscurity.

He inculcated the doctrine of an eternal self-existing Supreme Being, *Zeruane Akherene*, who created at first, by means of the living word (*Honover*) *Ormuzd*, the source of all good. In this being, equal in power and greatness to the Supreme Creator, are united the three original powers, the source of light, fire, and water; and his kingdom endures for ever and ever. Opposed to him is *Ahriman*, the prince of darkness, a morose and evil being, who, not created, but by divine permission having been suffered to come into existence, is allowed to continue, in order that the good may be glorified in its struggle against the evil.

In accordance with the will of the Supreme Being, Ormuzd created, by the word Honover, out of the source of light and water, the whole universe, and completed his work in six periods.

At first, he created his own abode, the dwelling of light, the heaven *Sakhter*, and the pure spirits. The highest among these were *the seven Amshaspands*, of whom Ormuzd himself was the ruler and chief. *Bahman* became lord of the empire of light, king of the universe, and dispenser of all happiness. *Ardibehesht* was constituted the genius of fire; *Shariver*, lord of splendor and of metals; *Stapandomad*, the source of all fruitfulness; *Khordad*, the genius of water and of time; and *Amerdad*, protector of the vegetable world, and the prime cause of growth in all living things.

The second class, *Izeds*, consisted of twenty-eight good spirits, of both sexes, who presided over and ruled the elements and all pure things. Their chief was *Mithras*, the sun, the vivifying and fructifying power. Next to him came *Tashter*, *Serosh*, and *Behram*, who were very much worshipped.

The third class were the *Feruers*. They are actually only the ideas of the Supreme Being embodied, and constitute, as a whole, the fundamental idea of the perfect world, of which the visible creation is an imperfect imitation.

Every being, even Ormuzd, the Amshaspands, and Izeds not excepted, has its Feruer, its type, which is the purest emanation from the deity; and every new creation or new creature is but the manifestation of a new Feruer. The abode of the Feruer is in the pure world of light where Ormuzd lives; here they sparkle even in the splendor of that light, by a more brilliant one of their own, and fly to the protection of the good whenever invoked by them. A representation of one of these Feruers will be seen on *pl.* 7, in the upper part of *fig.* 4, where he appears as if descended to protect the chief persons of the group, to whom he bears a strong

resemblance. He seems to emerge out of a circle formed by the bodies of two serpents folded around his body; in his left hand he holds a ring, while the right is lifted up and open, and a huge pair of wings are spread out as if to support him in his flight. A similar representation of a Feruer is seen in *fig.* 5.

When Ahriman, who was originally a good spirit, had fallen and rebelled, the Supreme Being set aside 12,000 years as the time during which the contest between darkness and light was to last, after which the empire of the former was to be destroyed.

During the first quarter of this period Ormuzd was to retain the supreme rule over the universe, during the second the contest was to begin, during the third the contending parties were to have equal power over the world, and during the fourth Ahriman was to have apparently the victory over his adversary, which would inevitably lead to the destruction of the whole visible world with the empire of evil, by a general conflagration, in order that the pure and the good might reign undisturbed and supreme.

As soon as Ahriman saw the world of good spirits which Ormuzd had created, he sought to fortify himself by creating a rival world composed of evil ones, *Devs.* The highest among these, over which he presided in person, were the *Arch-devs*, intended to oppose the Amshaspands. The Devs were the personifications of all vices, impurities, and noxious things.

While Ahriman was still confined with his creatures to the realms of darkness, Ormuzd created the sky, the sun, the moon, and the stars. He then made the fire, the wind, and the clouds, separated the solid part of the earth from the waters, bade the mountains to raise up their heads, and planted among them *Albordj*, the father of mountains, from which the sun and moon start each on its respective tour. The earth he after that divided into seven *Kashvars*, and called forth the vegetable world; first of all *Hom*, the type of all trees. Having thus prepared it to support animal life he created *Abudad* the great bull, from whose blood all the living things of earth have sprung.

As soon as Ahriman was released from his captivity, he attempted with his hosts to storm heaven, but was repulsed by Ormuzd, who continued his work of creating the terrestrial world. Repulsed from heaven Ahriman visited the newly made earth and killed Abudad; but the body of the bull became the germ of all kinds of animals and of the first man *Kajamorz;* him also the Devs slew, but Ormuzd then made a plant *Reivas* (man and woman combined) to grow out of the body. It gained its maturity in fifteen years, and bore as its fruits fifteen pair of human beings, the first of which were *Meshia* and *Meshiana*, the parents of the present race. After each period in the creation of the world and all that is therein Ormuzd rested and celebrated the festival *Gahanbar*.

Ahriman, disappointed by his previous failures, sought now to destroy the new creation. He blackened the fire with smoke, created different kinds of noxious animals and reptiles, and finally succeeded in seducing man from his allegiance to virtue. In the course of the fourth period he had

gained so great an influence upon earth as to lead men wholly to forsake the worship of Ormuzd, and to join the Devs in all their practices. Ormuzd, who pitied the fallen race, now sent them his law, first by his servant *Hom*, and afterwards by the great reformer *Zerdusht* or *Zoroaster*. But the people paid no regard to it, and hence Ahriman remained victorious for the last 3,000 years. Religion and virtue disappeared gradually from the face of the earth, and misery and destruction prevailed everywhere.

Thus will Ahriman continue to rule with an iron rod until the expiration of time, when *Sosiosh*, the promised redeemer, will come and annihilate the power of the Devs, awaken the dead, and sit in final judgment upon spirits and men. After that the comet *Gurzsher* will be thrown down, and a general conflagration take place, which will consume the whole world. The remains of the earth will then sink down into *Duzakh*, and become for three periods a place of punishment for the wicked. After these three periods Ormuzd will have compassion upon them and pardon their sins, and admit those into heaven who seek for it by penitence and prayer. The just will pass through the fiery ordeal without injury, and at once ascend into the heaven *Gorodmone*.

Even Ahriman and the Devs will after a more protracted punishment be pardoned and purified, and after a proper submission to Ormuzd be admitted into the regions of bliss. Then a new heaven and a new earth will be created free from the impurities of the old, and a fit habitation for the virtuous and good.

The Zendavesta, the sacred book of the Persians, contains what is taught concerning God and his work, as well as the moral law and that which pertains to their civil institutions. Their worship consists in reading this book, in adoring the sacred fire as a symbol of Ormuzd, in their sprinkling themselves with consecrated water, in praying to Ormuzd and the good spirits, and in partaking of the sacramental bread and cup.

Temples properly so called were not erected by the ancient Persians, neither were they in the habit of making likenesses of their gods; and images which did exist were looked upon with reverence, but never received any divine honors; they treated them in the same way as an enlightened Catholic may be supposed to treat the pictures and images of saints. *Pl.* 7, *fig.* 14, represents two ancient colossal idols of Afghanistan, but evidently belonging to a period of which we have neither record nor tradition.

We have already said above that Mithras, the Ized of the sun, was particularly an object of general adoration. *Fig.* 9 is generally considered a representation of a sacrifice by Mithras. A bull is evidently about to be slain in honor of the god; the animal having been thrown, struggles to regain his feet, which a youth, in a garment agitated by the wind, prevents by kneeling down upon him, holding with one hand the lower jaw of the beast, and with the other burying the sacrificial knife in his neck. A dog jumps up and licks the flowing blood, while a serpent and a scorpion appear by his side. Mithras the mediator is said to have brought this sacrifice as an atonement for the Ahrimanian original sin introduced into the world. Some consider this group as an emblem of nature on the approach of

summer, and think the bull represents the earth, and the blade the first rays of spring. Others again assert that this representation is by no means of Persian origin, because, say they, bloody sacrifices were never offered by them. But this is not true, for before Zoroaster's reformation, and even a short time after his appearance, such sacrifices were brought, as will be seen in *figs.* 1 and 2, which are copies of pictures representing two sacrificial processions, in which horses, oxen, lambs, and dromedaries are led to the altar.

A feature peculiar to Parseeism was the adoration of the sun (*fig.* 6), and that of fire (*fig.* 5), as the symbol of the animating principle which was in reality nothing but Ormuzd himself clothed in his divine power. *Fig.* 13 represents the celebration of the *Darun*, a ceremony performed at least once a month in commemoration of Hom, the giver of the law. The priest, after having said the prescribed number of prayers, now stands before the altar ready to partake before the devoutly kneeling assembly of the consecrated bread, a kind of unleavened cake, and of the juice of the Hom, a beverage somewhat similar to the Amrita of the Indians.

The priests of Parseeism belonged to the Magi, who formed a caste by themselves, the members of which never intermarried with other than the children of Magi. They were divided into different classes, to each of which was assigned its own occupation. *Pl.* 7, *fig.* 3 *a–e*, represents five of these, with the implements indicating their pursuits, viz. *a*, Iconologists, or sacred scribes (*Chartumim*); *b*, Magicians (*Asphin*); *c*, Astrologers (*Mechasphim*); *d*, Soothsayers (*Gasrin*); and *e*, *Gasdim*, a class whose occupation remains still unknown.

The priests were also divided into three classes: the Novices (*Herbeds*), teachers (*Mobeds*), and the perfect teachers or masters (*Desdur Mobeds*). They were distinguished by sacred vestments, consisting of the *Sadere*, a tunic with short sleeves and coming only down as far as the knee and girded with the *Costi* or sacred belt, which was to indicate that the priest was always ready to contest against Ahriman; in addition to these they wore the *Penom*, a mask which was to prevent them from sullying the sacred flame by their breath. The most prominent person in *fig.* 4 is that of a Median high priest. The face is somewhat disfigured, but the beard is ample and carefully arranged, while profuse locks cover head and neck. The dress consists of long and flowing garments coming down to his feet and supplied with apparently wide and hanging sleeves. In his right hand he holds a staff tipped with a broken ornament probably intended to represent an apple, in his left a lotus. One of his attendants holds a parasol over his head while another with a flybrush in one hand endeavors to keep the flies from his master, and in the other carries something resembling a handkerchief. Above is seen the already described Feruer. The human figures in *figs.* 7 and 8 have a very strong resemblance to this high-priest. They are of a colossal height and are generally called the *priest-kings*. Both are of a noble and imposing carriage and are dressed in long and flowing garments without sleeves. A rather low diadem encircles the thick and curly locks, and the long and pointed beard is curled in a way peculiar to

the kings of the nation. Each of the two figures is represented as seizing with one hand the strong horn so prominent on the forehead of the animal, while with the other he buries his sword in the body. The attitude of both during this act is quiet and self-possessed. A little difference will be perceived between the two animals. The one (*fig.* 7) is a monster with the body of a lion, the head and neck of an eagle, the feathers extending down over the back and resembling the scales of a coat of mail. The other (*fig.* 8) has a head resembling that of a wolf and legs like those of an eagle; the neck is covered with feathers resembling scales and with a mane; and the long wings extend down to the tail, which is long and has the bony appearance of a prolonged spine. The tradition among the natives is that these figures are a symbolic representation of the fights in which *Dshemshid* and *Rustan* overcame the evil spirits who had assumed the forms of monsters. It is said that the former, an old king, ruled over his people with so much wisdom and goodness that he made his kingdom flourish more than any other; but an enemy came and drove him from his land. Then arose Rustan (like the Hercules of the Greeks) and slew the usurper and freed the land from the oppressors. He was therefore looked upon as the benefactor and hero of his nation.

Similar figures of mythic animals, only more simple in form, are given in *figs.* 10 and 11, which are very probably intended as symbols for some duties, for it was customary to represent them symbolically under the forms of different animals, as the unicorn, the ox, the ass, &c. In addition to the above there are also two coins (*figs.* 12 *a*, *b*), dating from the period of the Sassanides, with figures that have reference to this religious system. The former of these we suppose to be the bust of a Magian or a high priest, and the latter a representation of fire worship.

III. EGYPTIAN MYTHOLOGY.

1. Introduction.

The mythology and religion of the ancient Egyptians is composed of various and often heterogeneous elements, in a greater or less degree connected with one another. Their growth and development were materially influenced by the physical conformation of the country, by which the inhabitants were early led to devote attention to mathematics and astronomy. But they owed many of their peculiar features more particularly to the mixed character of the inhabitants. People with widely different ideas and customs emigrated thither from time to time. While at one time the Arab and Phœnician sought the fertile plains of the Delta, there came, at a later period, the persecuted Brahmaists, driven out of India by the followers of Siva, who gained the ascendency. All these brought with them their creeds and rites, part of which were gradually grafted upon the religion of the country. Other sources of many modifications were the

domestic disturbances and wars which broke out from time to time, and brought in their train necessary deviations from the customary ceremonies, whilst, on the other hand, they caused the propagation of new ideas by the contact of different elements of the people. Thus arose, at different periods, entirely new systems, which wholly or partially supplanted those that were already established. But it was also very natural that during each contest of a new with an old system, no matter whether followed by the suppression of the latter or its amalgamation with the other, each would seek for the victory by its natural weapons, and hence new myths were introduced on all such occasions.

This will account for the various ingredients found in Egyptian mythology, such as *Fetishism*, particularly the worship of animals and plants, *Sabæism*, and the worship of nature in general; and with these strangely-connected *Anthropomorphism*, the worship of deified human beings.

It will, therefore, not appear strange that this mythology is so full of contradictions and uncertainties that it is almost impossible to speak with any certainty concerning the number, name, and particulars of all its gods. To the causes here enumerated, which render it difficult to gratify our curiosity, we must add another; the great unwillingness which the ancient Egyptian priests evinced to spread their knowledge beyond the precincts of their own temples, which caused them to invent a system of hieroglyphics bearing a double or triple signification, in which hieroglyphics they wrote the mysteries of their religion. Not until these hieroglyphics are deciphered will it be possible to have a perfect knowledge of the Egyptian antiquities.

The following is the result of the latest information drawn from the most reliable authorities. But before we enter fully upon the subject, we will preface the theogony by a myth which is as interesting as it is important to know; for it will show that the Egyptian mythology with which we are acquainted is of a later origin, and somewhat different from that of the primitive inhabitants.

1. Myth of Osiris and Isis. *Osiris*, the sun, and *Isis*, the moon, which were, with *Hermes*, the three most important gods of the ancient Egyptians, were at one time induced to descend to the earth to bestow gifts and blessings on its inhabitants.

Isis showed them first the use of wheat and barley, and Osiris made the instruments of agriculture, and taught them the use of them, as well as how to harness the ox to the plough. He then gave men not only the fruits of the field, but also laws, the institution of marriage, a civil organization, and taught them how to worship the gods. After he had thus made the valley of the Nile a happy country, he assembled a host, with which he went to bestow his blessings upon the rest of the world. He conquered the nations everywhere, but not with weapons, only with music and eloquence. His brother *Typhon* (*pl.* 8, *fig.* 21) saw this, and, filled with envy and malice, sought, during his absence, to usurp his throne. But Isis, who had returned, and held the reins of government, frustrated his plans. Still more embittered, he now resolved to kill his brother. This he did in the

following manner: After having organized a conspiracy of seventy-two members, he joined with them the feast which was being celebrated in honor of the king's return; he then caused a box or chest to be brought in, which had been made to fit exactly the size of Osiris, and declared that he would give that chest of precious wood to whosoever could get into it. The rest tried in vain; but no sooner was Osiris in it, than Typhon and his companions closed the lid, and flung it into the Nile. When Isis heard of the cruel murder, she wept and mourned, and then, with her hair shorn, clothed in black, and beating her breast, she sought diligently for the body of her husband. In this search she was materially assisted by *Anubis*, the son of Osiris and *Nephthys* (wife of Typhon), who was the fruit rather of a mistake than an infidelity. He was represented with a dog's head (*pl.* 9, *figs.* 6, 7, 8), and as having a dog's nature; but he was wise and good like his father. They sought in vain for some time; for when the chest carried by the waves to the shores of Byblos had become entangled in the reeds that grew at the edge of the water, the divine power that dwelt in the body of Osiris imparted such strength to the shrub, that it grew into a mighty tree, inclosing in its trunk the coffin of the god. This tree, with its sacred deposit, was shortly after felled, and erected as a column in the palace of the King of Phœnicia. But, at length, by the aid of Anubis and the sacred birds, Isis ascertained these facts, and then went to the city of Byblos. Arrived there, she seated herself before its walls as a servant seeking a place. The queen, who had just presented her lord with an heir, sent her servants out to procure a nurse, and they engaged Isis. The goddess, however, instead of feeding the child from her breast, put frequently her finger into its mouth, and then laid him during the night in the fire, in order to cleanse him from all earthly dross. One night she was watched by the queen, who, when she saw what the supposed nurse did to her child, shrieked aloud in despair; upon this, Isis immediately abandoned her disguise, and appeared as the goddess surrounded with thunder and lightning; striking the column with her wand, she caused it to split, and give up the sacred coffin. This she seized, and returning with it, afterwards concealed it in the depth of a forest, but Typhon finding it there, cut the body into fourteen pieces, and scattered them hither and thither. After a tedious search, in which she was not quite so fortunate as in the last, Isis found thirteen pieces, the fishes of the Nile having eaten the other. This she replaced by an imitation made of sycamore wood, and buried the body at Philæ, which became after that the great burying-place, and the spot to which pilgrimages were made from all parts of the country. A temple of surpassing magnificence was also erected there in honor of the god; and at every place where one of the limbs had been found, minor temples and tombs were built to commemorate the event.

But the story has also a sequel. As soon as the body of Osiris had been consigned to a suitable sepulchre, his spirit appeared to his son *Horus* (*pl.* 8, *fig* 19), and exhorted him to revenge against Typhon. The youthful god therefore proclaimed war against the fratricide, whom he vanquished

and made prisoner, and then delivered him bound to his mother. But Isis, full of compassion, and prevailed upon by the prayers and promises of the captive, set him again at liberty. Horus, enraged at her ill-timed clemency, tore the crown from her head, which Hermes (Anubis) immediately covered with the skin and horns of a cow's head (*fig.* 12), which ever after continued to be the insignia of the goddess.

Horus now waged for a second time war against Typhon, and forced him and his companions to hide themselves in the desert. He then mounted the throne of his father, and was the last god that honored Egypt by ruling over it as its king; for all its subsequent kings were mere mortals.

Osiris became after that the tutelar deity of the Egyptians, and his soul was supposed always to inhabit the body of the bull *Apis*, and at his death to transfer itself to his successor. *Pl.* 8, *fig.* 20, represents this bull attended by two genii with their burning torches, to indicate his resurrection.

Apis, who was in fact the same as Osiris, or rather the perpetual abode of his soul, must always be a perfectly black animal, with a white spot resembling a triangle on the forehead, another resembling a crescent on his right side, and under his tongue a lump somewhat in the shape of a beetle. As soon as a bull thus marked was found by those sent in search of it, he was placed in a building facing the east, where for four months he was fed with milk. At the expiration of this term the priests repaired at new moon with great pomp to his habitation and saluted him, Apis. The bull was then placed in a vessel magnificently decorated, and conducted down the Nile to Nilopolis, where he was again fed for forty days. During all this period women only were permitted to salute him. After certain ceremonies at Nilopolis he was conducted to Memphis, where his inauguration was concluded, and a temple with two chapels and a court for exercise assigned to him. Sacrifices were made to him, and once every year about the time when the Nile began to rise a golden cup was thrown into the river, and a grand festival was held to celebrate his birth-day, and however extraordinary it may appear, oxen were immolated to him. Marcellinus says, "during this festival the crocodiles forget their natural ferocity, become gentle, and do no harm to anybody." There was, however, one drawback to his happy lot, he was not permitted to live beyond a certain period; and if when he had attained the age of twenty-five years he still survived, the priest drowned him in the sacred cistern, and then buried him in the temple of *Serapis*. On the death of this bull, whether it occurred in the course of nature or by violence, the whole land was filled with sorrow and lamentations, which lasted until his successor was found.

2. Theogony of the Egyptians. The gods of Egypt were divided into three classes or orders, each of different rank from the others, while each successive series was supposed to have been an emanation from the one immediately above it.

They acknowledged as the highest deity *Amun*, afterwards called *Zeus* or *Jupiter Ammon*, the one great, almighty, and incomprehensible being. He was symbolically represented under the figure of a ram (*pl.* 8, *fig.* 6) with the disk of the sun upon its head, to indicate that he is the god of the sun,

as that luminary enters the sign of the Ram. Amun then manifested himself in his word or will, which created *Kneph* and *Athor*, the mother of the material world. Athor is represented (*fig.* 9) as the Egyptian Venus, accompanied by the dove held sacred to her. Kneph, who was of the male sex, breathed out of his mouth Athor, who was of the opposite sex. After this Amun caused another principle to emanate from the primordial night; this was *Phtha*, the god of fire and of life. He then formed out of the residuary matter *Tho* and *Potiris*, the upper and the lower heavens. Phtha now divided himself into a male and a female, *Mendes* and *Neïth;* and the sun, the moon, the firmament, and the earth were called into existence. These two, Mendes and Neïth, were the last emanations belonging to the first order of the gods. The second order, to which also a few of the gods belonging to the first are reckoned, consists of twelve deities, planets with the sun, the moon, and primordial principles of nature; and the third of seven, including also some properly belonging to the first and second orders.

The twelve great gods of the Egyptian mythology had each for his symbol one of the twelve signs of the Zodiac, and as satellites three attendants who in their turn had again two assistants each assigned them, and this system continued until the last class of subordinates amounted to 360; thus giving to each degree of the Zodiac a genius of this class to preside over it. The starry firmament was then divided into two sections; and the stars of the northern section placed under the influence of light and purity, while those of the southern section were ruled by darkness and the principle of evil. There were also six orders of demons; and every star, every creature, and every occupation had its own particular tutelary genius.

Upon this system was founded the study of astrology, to which the Egyptians were so much addicted, and which led to the doctrine that the souls of all human beings were at some previous time disembodied spirits or demons.

The Creator now resolved to call into existence a new race of beings, and with his breath sent forth a beautiful woman; this was followed by his creating in the same way many thousand souls made after his own image, and which he divided into sixty classes. These he commanded to procreate beings like themselves, and gave them the promise that he would animate these creatures by his own breath.

But they, prompted by curiosity, passed the boundaries of the celestial spheres, and seeing the earth, longed to inhabit it. To gratify and punish them at the same time, Hermes gave them bodies of earthly mould, and they became men and women. Their happiness was, however, of a short duration, for they remembered their lost pleasures and became discontented, and committed crimes upon crimes, until the earth and the elements complained of them to the creator. He then took compassion upon them, and bade Osiris and Isis descend upon earth and be born as children, in order to redeem the fallen race. They accordingly descended and made Egypt, the cradle of the human race, the scene of their deeds.

The course of a soul before it inhabits a human body, and after it has left it again, is described as follows: Accompanied by its guardian angel it is

launched into existence, with the privilege either to live in heaven or descend down to earth. If the latter be its choice, it is made to traverse the Zodiac until it reaches the sign of the Lion, the gate to corporeal existence, through which it goes down to the earth in the sign of Cancer, where it receives a human body and then is purified. After 3,000 years it reaches again in Aries the confines of the region where the celestial beings dwell. Here it is compelled to wait, and wander about for three days, before it is permitted to enter these abodes of bliss.

These are the things which are taught to the people, but the priests had mysteries where lessons were imparted far different from the religious instruction given to the people, but they were carefully concealed from the uninitiated. The mythology which the people considered as literally true was to the priest only a symbolic language for great truths expressed in figures, and the names of the gods with their mythic histories conveyed to them a meaning never suspected by the rest of their countrymen. But they were rigid in enforcing all the rites and ceremonies of the external worship, and inculcated a profound reverence for the creed as taught, in order to sustain their authority and power over the people.

2. Special Mythology.

1. Myths and Symbols. Having given an outline of the gods of the Egyptians, we will now examine the leading features of the principal deities and the myths appertaining to their history. The first of these deities, we have already said, was *Amun* or *Ammon;* he was the god above all gods, the infinite and eternal, the source of all life and being, from whom every blessing came, and who was too holy to be named by any one except the priests. We have already referred to his representation in Egypt. In Nubia we find him represented, as in *pl.* 8, *fig.* 7, seated upon a throne, with the war-club and key to the Nile in his right hand and the left raised as if in benediction. In Elephanta he is found represented, as in *fig.* 17, with the Nile key in his hand, standing between *Osiris* and *Isis*, who join their hands behind him as a sign of their intimate union.

Kneph, the creator of Osiris, is represented (*pl.* 9, *fig.* 1), seated, and with his hands stretched out as if about to create; his head is ornamented with rams' horns. On *pl.* 8, *fig.* 8, we give his likeness as *Kneph Mendes*, resembling that of the *Pan* of the Greeks. On *pl.* 10, *fig.* 18, is a copy of a coin upon which he is represented as a serpent called *Agathodæmon*, the good spirit The harmless serpent, particularly that of Thebes, was so called by the Greeks because they used it as a figure of the benevolent power of God, and this name was therefore also given to Kneph Mendes. Peculiar characteristics of the serpent representing him are also the hawk's head, and the swollen and erect body, and particularly the ornament upon the head, the highest mark of distinction. The ears and poppies with which he is surrounded are symbols of the blessings bestowed by this benevolent deity.

Osiris, who is next in rank, is the chief of the three highest deities to

whom temples were erected by the Egyptians. He was worshipped as the god of the sun, the source of warmth, light, and fruitfulness, in addition to which he was also looked up to as the god of the Nile, who annually visited *Isis* his wife, viz. the earth, by means of an inundation. The year and Tartarus were also subject to his sway. Hence do we find him represented in a variety of forms. *Pl.* 8, *fig.* 15, he is seen as a boy with a hawk's head riding upon a cow, the horns grasped in his hands; and on *pl.* 9, *fig.* 4, with a lion's head, while *fig.* 5 represents him with a bull's head crowned with a crescent. The lion's head he has in his capacity as god of the Nile, whose annual rising was symbolized by the figure of a lion.

Pl. 10, *fig.* 10, shows us a statue of the god with the hawk's head looking upwards, and holding in his left hand the key of the Nile; and *fig.* 11 is another representation of the god, wrapped in a long and ample garment, holding in his right hand a staff ornamented with a hawk's head similar to his own. *Pl.* 8, *fig.* 16, is intended either for Osiris with the Serapis serpent, as the god of Tartarus, in which capacity he is considered as one and the same with *Serapis*, or it is to represent Serapis himself. The latter, it is asserted by some writers, was a separate deity, ruler of Tartarus and god of medicine, in which latter capacity the serpent is appended as the symbol; others considered him also as god of the sun, and as such he is seen in *fig.* 23, with the rays around his head, and encircled by the folds of the serpent. He is also regarded as the presiding deity over the rising Nile, and in that capacity he is wrapped in a long garment, *pl.* 10, *fig.* 7, holding a staff in his hand and carrying a corn measure upon his head. This latter attribute is always found about his person, no matter what the form under which he is represented. He is seen thus in *fig.* 8, seated upon a throne and his feet covered with sandals, while his right hand, without the staff, is raised over his shoulder and the left resting upon his knee. *Figs.* 5 and 6 seem on the contrary to confirm the assertion that Osiris and Serapis were one and the same person, who was called by the one or the other name, and represented according to the capacity in which for the time being he was supposed to act; for these figures are intended for Serapis and Isis closely united, and it will be remembered that Isis was the wife of Osiris, the god of the sun. Another fact in corroboration of this opinion is that Osiris was buried in the temple of Serapis, where he was worshipped more than at any other place. Nevertheless it is probable that Serapis may have been substituted for Osiris, which some say was actually the case after the time of Alexander; and if so, he was considered ruler of the elements, bearer of the keys that unlock the waters everywhere, and particularly those of the Nile, god of the earth as well as the presiding deity over all the powers of matter and king of Tartarus. In this character it necessarily followed that he was the source of life, and the judge of the dead, to punish or pardon according to his own good pleasure.

A coin has also been preserved (*pl.* 8, *fig.* 24), upon which he is represented with a corn measure upon his head and surrounded with seven heads, intended for the seven planets, who are in their turn encircled by the Zodiac.

Isis, the wife of Osiris, is represented in a variety of forms besides those already mentioned. *Pl.* 10, *fig.* 1, represents her head decorated with Egyptian ornaments. On *pl.* 8, *fig.* 10, she is seen in a youthful form, her head ornamented with the emblem of divine authority, seated upon the flower of the lotus, holding in her right hand a whip, the symbol of government. *Fig.* 13 represents her as a star in the heavens surrounded by the symbols of the four elements, the eagle (air), the salamander (fire), the lion (earth), and the fish (water). *Pl.* 10, *fig.* 2, is a copy of a coin upon which she is represented as queen of the ocean, her garment agitated by wind and holding in her hand the *sistrum*, while she is in the act of unfolding a sail. In this form she was worshipped under the name of *Pharia.* The *sistrum*, of which we give two different drawings, one on *pl.* 8, *fig.* 28, and the other on *pl.* 9, *fig.* 23, was a musical instrument invented by Isis and made use of in the service of the temple for the purpose of beating time. It was of an oblong oval form, narrowed towards the lower end and hollowed out in the centre with four strips of metal fastened over it. Sometimes she is represented in her character of a mother, as in *fig.* 2, where she nurses, as some say, Osiris, who is seated upon her lap with the crescent on his head. On the back of her chair are two hoopoes, symbols of filial love, and upon the table before her is a vessel with a long spout and a handle in the shape of a serpent. This vessel was made use of in the ceremonies of the mysteries belonging to the worship of several gods of the elements, and was the jug which as a water vessel was sacred to the gods of that element, while the lamp attached to it indicated its use in the worship of fire, and the serpent called to mind the powers of nature ever growing and ever renovating themselves. Osiris is sometimes also found grasping a staff ornamented with the head of the hoopoe. Another figure of the same import is given in *pl.* 8, *fig.* 14, where Isis is seen with the head of a cow.

Here it becomes necessary for us to say that the incongruity by which Osiris, the husband of Isis, is presented as her son must be either owing to a mistake in consequence of which his name has been substituted for that of *Harpocrates*, a younger son of the goddess, or must have had its origin at a later period when a new system assigned to Isis her original rank among the gods, while Osiris was placed among the deities of the second rank. Twice we find the goddess represented as nursing *Horus;* first on *pl.* 10, *fig.* 9, where she is seated upon a chair, without any attendants, holding the child upon her lap; and again *pl.* 9, *fig.* 3, where Horus, as a half-grown boy, stands by her side to be fed from her breast. Before her we see a priest apparently with an offering of lotus; immediately behind her sits *Hermes*, keeping the sacred records, and behind him Osiris holding the staff in one hand and the key to the Nile in the other.

There are three very fine and even artistic statues of Isis which we have copied on our plates. *Pl.* 8, *fig.* 11, represents her dressed in a closely fitting transparent garment holding a lotus or palm-branch in her left hand, her head and a part of the face almost concealed beneath the folds of a curiously wrought head-dress. *Pl.* 10, *fig.* 3, is a very elaborate work,

particularly the rich drapery and the manner in which it is disposed over the under-garment; the attributes are the sistrum in her right hand and the sacred cruse in her left. In *fig.* 4, the youthful-looking head of the goddess is finely set off by the long braids that fall over her neck and shoulders, while the loose upper and longer under garments envelope her whole figure; in her right hand she holds the sistrum.

Harpocrates, the youngest son of Isis and Osiris, was the symbol of the sun when in its feeble condition, just after the winter solstice, it appears with its faint rays as if just called into existence. On a coin (*pl.* 8, *fig.* 25), we see a bust of this boy-god, and on *pl.* 10, *fig.* 14, a statue of him with a cap ornamented with rams' horns, with his hand raised as if in the act of placing the fingers upon his lips. The Greeks considered this as a symbol of silence, and hence called him the god of silence. *Fig.* 15 represents him mounted upon a ram which carries a ball upon its head; his left hand is armed with a club, while he here also appears to place his right hand upon his lips. He carries the club because he was considered the Hercules of the Egyptians.

Anubis, the son of Osiris and Nephthys, has already been mentioned in the myth which relates the labors and death of Osiris. Concerning him it was thought that his mother, afraid of her husband *Typhon*, exposed the babe in the desert. There Isis found him, attracted to the spot by some of her dogs. After carrying him home with her, she nursed him with great care, and found the reward of her charity in the faithful services he rendered her afterwards as a friend and watchful guardian. He was also made a guardian to the gods, and discharged the duties just as the dog fills that office among men, and hence we find him often represented in the form of a dog, as in *pl.* 9, *fig.* 8, where he is seated between *Canop* and *Horus*. Sometimes he is found with the body of a man and only the head of a dog, as in *fig.* 6, where a cloak is thrown around part of his person. In his left hand he holds a staff resembling a caduceus, and his left foot is planted upon the back of a crocodile; and *fig.* 7, where he is seen by the side of Isis, represents him likewise with a human body surmounted by the head of a dog. In this form he is considered as one and the same with *Hermes*, or *Theut*, or *Thot*. There are two other statues of him (*pl.* 10, *figs.* 12 *and* 13) that differ but little from those already described, only the former is furnished with a plainer kind of caduceus, and a branch which is placed in the left hand of the god; while the latter represents him with a palm branch in his left, and the club in his right hand. As *Hermes*, he is sometimes seen with the head of the Ibis surmounted by a lyre (*pl.* 8, *fig.* 18). Under this name he was also known as the friend and counsellor of Osiris, the inventor of spoken and written language, of grammar, astronomy, surveying, arithmetic, music, and medical science. He was also held to have been the first who framed laws for the human race, and taught man how to worship the gods and erect temples to them. The discovery of the olive tree as well as the instruction how to use its fruit is also ascribed to him.

The statues which represent him with the head of an Ibis instead of that of a dog are of a later date, and owed their origin to the following legend: As

soon as the nilometer indicated a rise in the river, the Ibis was seen busy along its shores devouring the vermin driven back by the water. Hermes was the first to observe this, and devised at the same time a correct standard for measuring the gradual increase of the flood. This he described in hieroglyphics, chiefly by the figure of an Ibis. Hence was he represented with the head of this animal instead of that of the dog, to indicate his talent as a geometer, or rather nilometer.

Pl. 8, *fig.* 22, is a copy of the statue of the god *Ailures* with the head of a cat; but little is known of this idol. The wolf (*pl.* 9, *fig.* 9) was the guard of *Amenthis*, the Hades of the Egyptians, and was one of the attributes of Osiris or Serapis, in his capacity as ruler of the infernal regions.

The head-dresses with which the Egyptians ornamented their idols differed much in appearance, but were always characteristic, and sometimes even gorgeous. The most curious will be found in *figs.* 11–14.

In addition to the gods worshipped in the temples, the ancient Egyptians had also a kind of domestic gods, who were very highly revered. But as they were only idols of particular families, they were not only very diversified in appearance, but had even the most grotesque and often rude forms, as will be seen from the specimens which we give (*figs.* 17–19, and *pl.* 8, *fig.* 27, *a*, *b*, *c*).

After what has been said of the gods of Egypt, and the forms under which they were represented, it is not surprising that living animals were also worshipped or regarded as sacred by the people of that country. But those so distinguished were not all of the same character, for the useful and harmless ones enjoyed this distinction as a mark of gratitude, while fear dictated a similar offering to the noxious beasts and reptiles, in order to propitiate them. Neither were the same animals equally esteemed in all parts of the country; for those that were worshipped or considered sacred in one section were often despised and even killed in another. Only a very few enjoyed a universal reverence. Thus, we find that every household had its sacred bird as a tutelary deity, which was carefully tended and provided for. When one of these sacred animals died, it was brought to the priest to be consecrated. The body was then embalmed and placed in a tomb in some temple or sacred burying-ground. The pains taken with the body depended altogether upon the degree of sanctity ascribed to the animal. The *Falcon* and the *Ibis* were treated with marked distinction in this respect. Small animals were also sometimes, after they had been embalmed, placed in vessels of clay or stone, and thus preserved in the family; but of the larger class, only one or a few limbs were embalmed, and then wrapt round with linen, on one end of which the head was fastened, or often only a rude likeness of it painted.

Only a few forms of the symbolic and mythic animals belonging to Egyptian mythology have been handed down to us. Some of these will be found on *pl.* 9, *figs.* 20 and 21, and on *pl.* 8, *fig.* 29, the last representing the sacred *Camel*, the two former probably intended to represent the *Phœnix*, a fabulous bird, who was said to have had a golden plumage. In size and form it was thought to resemble the eagle. It was said to

visit Egypt only once in five hundred years, in order to consume itself by fire, and then to arise out of its own ashes in renewed youth. The *Sphinxes* were also fabulous creatures, variously described, and divided into male and female sphinxes. Usually they are found with the body of a lion and the head of a woman, covered with the sacred cap, which was a head-dress with very ample folds; the body is generally seen stretched out like that of a lion when at rest, as in *pl.* 10, *fig.* 23. Sometimes, though rarely, they are found with a lion's head upon a lion's body (*fig.* 24). There is another copy of a sphinx (*pl.* 9, *fig.* 22) taken from an Egyptian coin, struck off in the reign of the Emperor Hadrian, which deserves particular notice, on account of the numerous attributes of divinity with which it is surrounded. The head is ornamented with the lotus; the front part of the body covered with a veil, which falls down over part of the limbs, and from the breast projects the inverted head of a crocodile; upon the back sits a griffin with a wheel in his claws, and beneath the feet of the sphinx a serpent strives to drag its body forward. The body strongly resembles that of a lion, with the head of a woman. Mythologians, as well as antiquarians, are still divided in their opinions as to the typical meaning of these monsters.

They were usually found before the entrances to the temples, as guardians (*pl.* 10, *fig.* 35). Some think that they were the emblems of wisdom and power, but others ascribe to them an astronomical signification. The Egyptians considered them, like all other monsters, as created by *Typhon* and *Nephthys*.

Among the other symbols of Egyptian mythology we mention particularly the *flower of the lotus* (*fig.* 25), which occupied a prominent place among them. It was the most sacred plant of the Egyptians, and served as the emblem of the world as it emerged from out of the deep. Gods and goddesses ascended out of its cup, and from it the people drew lessons which taught them to hope for immortality and happiness, even amidst the terrors of death. Hence do we find it not only as an attribute of the gods, but also frequently by itself in their temples, their pictures, and elsewhere. The Nile, too, had its symbol, which is represented (*fig.* 16) in the form of a man with a cornucopia in his hand, out of which a child appears to ascend, while he seems to watch its motions. Before him stand three other children in a supplicating attitude, and by his side lies the mysterious sphinx. The Nile key, or Egyptian cable (*fig.* 17), which we have already mentioned, is a symbol concerning which not much is known, except its form. Some say that it was intended as an emblem of the four elements, others that it was a nilometer, and a few contend that it was a symbol of authority over the earth, or of the division of the year into four seasons. As symbols may also be regarded the attributes of the sun (*pl.* 8, *fig.* 1), viz. the serpents and the two wings, which were symbolic of eternity and motion, and the all-seeing eye (*fig.* 2), which represented omniscience. In connexion with the symbols we must also mention the *sacred ship* (*fig.* 3). This vessel was an object of general reverence and profound regard. It is sometimes found as if resting on a pedestal, and in other places surrounded by

many priests, who carry it by means of long poles. The centre seems to be occupied by a little temple, around which are grouped a number of figures and ornaments, as cherubim and other representations of a similar kind, while the prow and the poop are ornamented with rams' heads. *Figs.* 4 and 5 are two other but simpler forms of this same vessel. The figure seen in the latter is probably intended for the body of Osiris, after he had been slain by his brother Typhon. It is uncertain whether it was placed there in commemoration of the act of launching it upon the waves of the Nile, or of Isis's devotion in carrying off the body after she had discovered it at Byblos. It was a favorite device of the Egyptians to represent the gods as going about in vessels; and they kept the idols generally in large boxes which were deposited in the sacred ship, whence they were removed during festival seasons or for sacrificial solemnities, and placed in the temples dedicated to them.

2. Worship and Priesthood. Sacrifices, which were sometimes of a bloody character, and music constituted the main features of the worship performed in the numerous temples dedicated to the gods. *Pl.* 10, *fig.* 35, represents a sacrifice brought to Isis in one of her temples.

A great variety of sacred vessels and utensils were employed in the temple service, most of which were wrought with great skill and taste. We have represented a few of them on our plates. *Pl.* 9, *fig.* 24, is a kind of cup; *figs.* 25, 26, and 27, are two jugs and a pitcher, and *fig.* 28 an ancient flask or bottle. The most valued and esteemed vessels were the so-called *Canopæ* or sacred jugs (*pl.* 8, *figs.* 26 *a*, *b*, and *pl.* 9, *figs.* 15 and 16). They were brass vessels wide in the body, with narrow necks and covers, made in the shape of the head of some deity: sometimes they were also covered with hieroglyphics. We cannot with certainty say for what purpose they were used, but it is probable they were employed as depositories for the sacred water drawn from the Nile. They seem to have served in astronomical observations for measuring time in the manner of hour-glasses in which water was used instead of sand. This was done by placing one jug with a small hole at the bottom and filled with water, over another empty jug of the same size without an opening at the bottom. When the time for the astronomical observation had come, that is as soon as the watched for star made its appearance on the horizon, they removed the stopper from the aperture in the upper vessel. The water which now ran into the graded vessel beneath it, during the time which elapsed between the first appearance of the star and its reappearance on the following night, served as the standard by which to measure the course of every movement in the starry heavens. Not only the course and periods of the stars but also the length of the days and nights were calculated by the help of these little instruments, and those that were set aside for that purpose were ornamented with covers resembling a dog's head or a dog sitting upon his haunches.

The guardians of this mythological system and of the sacred rites connected with it, the priests, formed a separate caste. The cultivation of arts and sciences was their special province. All legislative and judicial power

was vested in them. They governed the land under the presidency of the king, who applied to them for counsel and acted under their tutelage. Their sons were his playmates in his childhood, his companions during his youth and manhood, and his life was spent in accordance with the rules prescribed by them, which were so minute in their details as to specify the time when he must walk and bathe. When the reigning family became extinct a successor was chosen from among the priests. But these prerogatives never contributed to the aggrandizement of an individual at the expense of the class; they were the property of the whole body, and no matter what the personal talents, merits, or honors of any one might be or become, he had no exclusive right to them, but his merit was ascribed to the entire caste. The priests were, therefore, not honored by the people for their personal merits, but only for belonging to the caste of priests.

The caste was divided into different classes, holding different ranks: 1. The *Prophets*, or orators, who superintended the worship in the temple, had charge of the government of the order and of the public revenues. 2. The *Stolists*, whose duty it was to impress the seal which was the mark of consecration upon the animals selected for sacrifice. 3. The *Hierogrammatists* or sacred scribes, who were the scientific men of Egypt. 4. The *Horoscopists*, who occupied themselves with astrology and magic. 5. The *Minstrels*, who devoted their time to music and hymns, and occupied the front in all processions. 6. The *Pastophoroi* (box carriers), whose chief occupation was the practice of medicine. They are represented in *pl.* 10, *figs.* 26–31, most of them distinguished by some mark of their profession. Some of them had even the attributes belonging to a god, as *fig.* 27, who carries the staff with the falcon's head. *Figs.* 32–34 seem to be priestesses; but it is still doubtful whether they were invested with the privileges of officiating at the altars, or were only attendants in the temple.

In addition to the above division there was another by which each of the greater gods and goddesses was furnished with his or her own college of priests, who had the charge of the temple and worship of their patron divinity. *Pl.* 8, *fig.* 31, are two priests and two priestesses belonging to the temple of Isis; the first of these carries the sacred jug; the second probably the sacred books; the third follows with the large pitcher, the handle of which is the crawling serpent; and the fourth has in one hand the sistrum and in the other a ladle with a long handle carved as if for a measure.

The priesthood was hereditary in Egypt, as well as the property belonging to the temple. The style of dress and mode of living were strictly prescribed to the priest. He had to keep his head shaved, except when a member of his family died, and then he wore his hair as a mark of mourning. His dress consisted of a linen gown and tunic more or less long, and shoes of rushes or papyrus. His drinking vessels had to be washed and cleansed daily, and he himself was required to bathe twice every day and every night. His food he had to select with the greatest care; he was not allowed to eat fish or any indigestible or flatulent food, particularly pork, which he was not permitted even to look at; but on the other hand he and the king were the

only persons to whom the use of wine, though in prescribed quantity, was allowed.

The *votive-hands*, so frequently found, must here be mentioned on account of their close connexion with the vocation of one class of the priesthood. We have already said that the *pastophoroi* were also the physicians of the people, and as such belonged to the colleges of priests who served in the temples of Serapis and Isis. The sick and afflicted repaired therefore to this temple to be cured, and whenever they were restored they deposited there as offerings of gratitude these votive-hands, of which we give copies on *pl.* 10, *figs.* 19–22, and during the festivals in honor of the god or the goddess they were carried about upon long poles as trophies of his or her power. All these hands of bronze, as will be seen on the plate, had the thumb with the fore and middle fingers stretched out, while the others were bent down to the palm.

The first hand, *fig.* 19, has on the inside of the fore and middle fingers the head of Serapis, and on the palm of the hand two other symbolic marks; just above the wrist is a bracelet, beneath which is seen the figure of a woman in a recumbent position, with a child on one side and an ibis on the other. *Fig.* 20 has the head of Serapis in the same place as the other, but instead of the palm this shows the back of the hand covered, with a miniature drawing of a serpent, a toad, a lizard, a pair of scales, a jug, and a few hieroglyphics. *Fig.* 21 is a hand showing the palm; the end of the thumb has the shape of the head of Serapis, and upon the second joint of the bent fingers is a miniature ram's head; a serpent entwines the wrist. *Fig.* 22 is a drawing of the back of a hand, with the head of Serapis in the same position, a tortoise and several vines covering the centre of the hand, while a serpent which encircles the wrist stretches out its head towards the thumb. All these hands are right hands, and in every one the fingers are found in the same position. This has led to the supposition, it is true upon very slight grounds, that the cures in the temple were performed by a kind of animal magnetism which it is thought was well understood by the priests.

3. The Mysteries. The system of secret doctrines adopted by various nations of antiquity, and which was known as *The Mysteries*, was also in high repute among the Egyptians. These doctrines were diametrically opposite to those held by the people. They had two kinds of mysteries in Egypt, the *greater* and the *lesser;* the former taught by the priests of Osiris and Serapis, the latter by those of Isis.

The first cause of the introduction of symbols was the profound ignorance of the people, which compelled the more enlightened, whose views about the deities were more developed, to speak to them in parables and figures in order to be understood at all. This system of symbols increased at last to such a degree that the explaining of them became a distinct branch of study wholly confined to the priesthood. The people in their great ignorance were naturally inclined to regard the symbols as the very things or ideas which they allegorically represented, without troubling themselves about understanding the allegories in their higher connexion, or in other

words to be initiated into their mysteries. The priests, perceiving the tendency and the advantages which it gave them, became more careful in concealing the truths which they at first had sought to propagate. They required therefore that a candidate for initiation into the mysteries should be of a mind sufficiently cultivated and enlightened to understand and practise the lessons taught by them to their disciples, and that he should have lived a pure and moral life. Even when these conditions were fulfilled a number of preparations and tests had to be gone through, and a solemn and fearful oath of perpetual silence was administered. The initiation itself was accompanied by many and strange ceremonies. The novice was then instructed gradually, at first still in symbols and by degrees only, and as he advanced from step to step he was made acquainted with their true meaning, and what they were intended to convey.

The manner of proceeding was as follows: When a candidate offered himself for initiation he was required to spend a week in solitude and meditation, and to purify the body by frequent ablutions and severe mortifications of the flesh. Then he was ordered to enter the pyramid during the night, where he had to descend by aid of his hands and feet through a narrow passage without steps, until he reached a cave-like opening, through which he had to crawl to another subterranean cave, where three priests, disguised as jackals, sought to frighten him, first by their appearance and noise, and afterwards by enumerating the dangers that awaited him on his journey onwards. If his courage did not fail him here, he was permitted to pass on to the hall of fire. This was a large apartment lined with burning stuffs, and whose floor was a grate painted flame color; the bars of this grate were so narrow that they offered scarcely room enough for the sole of his foot. Having passed through this hall, he came to a canal which he had to cross by swimming. As soon as he reached the opposite shore, he found his passage obstructed by an iron door. While vainly striving to force his way, the earth suddenly began to quake beneath his feet; he sought for support from the iron rings inserted in the door, but he no sooner grasped them than he felt himself abruptly lifted up in the air, exposed to raging and piercingly cold winds. When he was almost exhausted by his sufferings, he was gently let down and the door opened before him of its own accord. A dazzling light filled the apartment of the temple into which he found himself suddenly introduced, and before and around him stood the whole band of priests, dressed in full regalia, and singing hymns in praise of their divinity.

There he was made to kneel before an altar, and take the solemn oath which bound him to secresy. He was then retained for several months in the temple, where moral trials of different kinds awaited him. The object of this was to bring out all the traits in his character, and to test his fitness for his vocation. After he had passed through this trial, there came what was called his *manifestation*. This consisted of a number of ceremonies, of which the novice was the subject during the space of twelve days. He was dedicated to Osiris, Isis, and Horus, and decorated with the twelve consecrated scarfs (*stolæ*) and the Olympic cloak. These scarfs were

embroidered with the signs of the zodiac, and the cloak with figures that were symbolic of the starry heavens as the abode of the gods and happy spirits. A crown of palm-leaves was placed upon his head, and a burning torch in his hand. Thus prepared, he was again led to the altar, where he renewed his oath, and called upon the gods to visit him with their direst wrath if he should ever be so unfortunate as to violate his solemn oath and obligation.

This terminated his initiation, and entitled him to be instructed in what was called the *lesser mysteries*, and in the writings of *Thot,* which were in some degree connected with these mysteries.

Now came the time when he had a right to appear as victor before the people, and to this end they prepared for him a solemn procession, called The Triumphal March of the Initiated (*pl.* 9, *fig.* 29), which was proclaimed by heralds in every quarter of the city.

On the morning of the day appointed for this ceremony, the priests assembled in the temple, where the most precious treasures belonging to the sanctuary were displayed, and repaired to the chapel of Isis to bring a sacrifice to the goddess, covered with a veil of white silk, and embroidered with golden hieroglyphics, and this again concealed beneath a black gauze. After the sacrifice, the procession left the temple and moved westwards. First in the train came an image of Isis seated upon a triumphal car drawn by white horses, next to which walked the priests in the order of their rank, dressed in their most gorgeous attire, and carrying the sacred symbols, the utensils of the temple, the books of Thot, and the sacred tablet of Isis, which was a silver plate with the hieroglyphics that referred to the mysteries of this goddess engraved on it. The priests were followed by all the native and foreign adepts, dressed in white linen garments. The newly initiated walked in their midst, distinguished by a white veil which extended from his head down to his shoulders. All the houses of the streets through which the procession passed were decorated as on festal occasions. Flowers and perfumes were everywhere thrown over the person of the novice, and his arrival greeted with shouts of rejoicing.

After his return to the temple he was placed upon an elevated throne, before which immediately afterwards a curtain descended. While the priests chanted during the interval hymns in honor of the goddess, he divested himself of his holiday suit, and assumed the white linen garb which he was henceforth to wear. The curtain was now again raised, and the renewed shouts of the spectators greeted him as an adept. The ceremonies concluded with a festival, which lasted three days, during which the newly-made brother occupied the seat of honor.

4. Astronomy. The science of astronomy was probably better understood by the Egyptians, or rather by their priests, than by any other nation of antiquity. We have already stated that one class of priests devoted all their time to it. As a proof of the great advances they made in it we refer to the picture of the Egyptian zodiac (*pl.* 8, *fig.* 30), found on the ceiling of one of the oldest temples of the country, situated in the wretched village of Denderah, which occupies the site of the

ancient Tentyra in Upper Egypt. This picture was afterwards removed and carried to France. It is composed of a great number of figures and hieroglyphics, arranged in a certain order. We notice first the external circle inscribed with a number of hieroglyphics which follow one another in regular succession. This circle is divided into eight equal parts by four erect female forms and four pair of kneeling female twins with sparrow-hawks' heads. These figures appear also to support the weight of the inner circle.

The picture within the latter circle contains quite a number of hieroglyphics of all kinds. We will endeavor to examine them in their astronomical order. The first figure in this order is that which is seen a little to the left, just beneath the centre of the disk. It is a lion with a serpent under his feet, and a woman behind him. This was the true zodiacal representation of the sign *Leo.* Next to this group, if we turn to the left, comes a woman with an ear of wheat in her hand, and a man with something like the attributes of Osiris. This is intended for *Virgo.* Further on we see *Libra* with the scales, *Scorpio*, *Sagittarius* in the shape of a winged centaur, *Capricornus* half goat half fish; then comes a male figure pouring water out of two vessels which is *Aquarius*, followed by *Pisces*, two fishes united by a triangle and the hieroglyphic for water; next to these we see *Aries*, *Taurus*, and *Gemini*, and finally the last sign in the ring, which is *Cancer*, over the head of Leo, whereby the latter appears the first in the order of the zodiac. A great number of other figures are also there, both within and without the spiral line of the zodiacal signs. These represent the most important constellations next to those of the zodiac. The erect clumsy animal which occupies nearly the whole centre of the disk, is an ancient figure for *Ursa major*, hence the north pole is pretty nearly in front of it. The position and order of the 36 figures which are seen on the very edge of the inner circle are interesting. They were intended for the 36 *Decanes* or good spirits, to whom the care and protection of the human race were intrusted. To each was assigned a particular limb or part of the body as the object of his peculiar care, and which he had to guard against the power and influence of the evil spirits.

The hieroglyphic marks around the individual groups are merely the respective names of the different Decanes, *e. g. Chnumis*, *Chachnumis Uare*, &c.

5. Doctrines concerning the Future State of the Soul. The idea of a future state was closely connected with astronomy. The Egyptians believed in the immortality of the soul, and in its partial transmigration. Life upon earth they looked upon as of no great importance, but they valued as a very estimable thing a good conscience, which could be carried beyond the grave. Hence they bestowed but little care upon the dwellings of the living, which they looked upon merely as inns, only intended to accommodate the wanderer on his journey home; but the tombs of the dead were to them the permanent abodes of mankind, and were therefore built with great care, and without regard to expense. Some think that they embalmed the body only as a symbol of the purification which the

soul had to undergo before it could enter the place of eternal rest; others say it was done in consequence of a belief that the soul could preserve its individuality only as long as the body preserved its own, and that as soon as the latter had returned to its native dust, the former was compelled to commence its transmigration through the bodies of the inferior animals, and continue it for three thousand years, at the end of which period it was permitted to enter again a human body.

They believed firmly in a rigid judgment beyond the tomb, for they thought that shortly after the separation of the soul from the body, the former, before it could enter into the peaceful realm of the departed, had to appear before Osiris, the stern judge of the lower world. Here its life upon earth underwent a close scrutiny, and according to the degree of its past piety or wickedness was the amount of reward or punishment awarded to it.

Pl. 9, *fig.* 10, is a picture of this tribunal of the dead, as described by the ancient Egyptians. To the left, which appears to be the entrance to the judgment-hall, is a group of three persons; the one nearest to the entrance appears to be a priestess, who prays jointly with the figure before her, that of a departed soul, that the latter might be permitted to present itself before the god who is seated in the back-ground upon the judge's throne. These prayers are evidently addressed to the female who confronts them, and whose attributes indicate that it is Isis. Behind this goddess are the immense scales in which the deeds of man are weighed. They are attended by two persons, one with a hawk's head, and the other with that of a jackal, who seeks to steady them. These attendants are probably only representations of the same divinity in different capacities. Above the centre of the beam is a figure with a dog's head, probably intended for Anubis, accompanied on each side by a miniature sphinx. A weight similar to the one in the scale hangs down from the beam; and in the scale to the right is a substance somewhat resembling a plant. Immediately behind the scales stand the divine scribe Thot or Hermes, with the head of the Ibis, engaged in noting down the result of the inquiry as ascertained by the scales. In front of the scribe we see Harpocrates seated on a crook, in one hand a flail, and in the other a small crook; and upon the altar sits a monster with the body of a lion and the head of a boar, almost in contact with the lotus, upon whose leaves four mummy-like figures are seen, one with the head of a man, another with that of a dog, the third with a jackal's, and the fourth with a hawk's head. The last figure in the picture is Osiris upon his throne, the crook in his right and the flail in his left hand; and before him, hovering in the air, a little animal like a horse, with the head severed from the trunk, and the latter transfixed by a spear.

Though it cannot be denied that every explanation given of this symbolic picture must be the result of mere conjecture, yet it is certain that it was intended to convey the idea *that there is another life beyond the grave, where every one will meet with a just reward for the deeds done in the body.*

6. The Abraxas. Before we conclude the Mythology of the Egyptians,

we must mention the *Abraxas* (gems well known to all mythologians and antiquarians) to which the ancients attached a symbolical meaning. *Abraxas*, the name by which they are distinguished, is said by some to be a word composed of Greek letters, the numerical value of which was 365; others hold that it is a compound of the Egyptian words *Abrac* and *Sax*, which signified either the *Saviour*, or *Mithras*, the sun, if it was not meant for *the sacred mystic word*. Basilides of Alexandria, a Gnostic, who endeavored to connect all kinds of ancient philosophic elements with Christianity, considered this word as the symbol of the deity from which 365 spirits came forth by emanation. The Abraxas figure found upon these gems (*pl.* 14, *fig.* 30), he explained as symbolizing the seven primary powers of the deity, viz. the serpent's feet, thought and reason; the cock's head, wisdom and foreknowledge; the whip in the left hand of the figure, power; and the circular shield, equity and peace; while the trunk was the symbol of the eternal uncreated Father of All. The followers of Basilides valued gems of this kind very highly, and carried them about their persons as amulets. These gems must be carefully distinguished from the *Abraxoides*, for the figures upon the latter, though in the style of Abraxas, referred generally to something taught by the Christian gnostic sects. There were also some gems known as *Abraxasters*, which were altogether different from the two already mentioned; the devices and inscriptions upon these always had reference to strictly Pagan subjects (*pl.* 7, *figs.* 15–17; *pl.* 9, *figs.* 30, 31).

IV. MYTHOLOGY OF THE BABYLONIANS, SYRIANS, AND PHŒNICIANS.

The mythology of these Eastern nations may be considered as the well-spring or fountain whence first came those corrupt streams of idolatry, which receiving numberless accessions in their onward course, deluged all the heathen world with false gods.

The basis upon which the mythology of these three nations was founded was very nearly the same in all: it was a worship of nature, and particularly of the stars. The objects thus deified were also more or less common to them. If we consider their political relations and commercial intercourse, it will appear evident that they must have exchanged with one another many of their religious ideas. This, together with the great want of copious and reliable authorities, contributes materially to the obscurity which still exists with regard to the essential points of difference between their systems.

The supreme gods of these nations were the same, only worshipped under different names; and their respective cosmogonies show that their mythological systems must have sprung from a common source.

The *Babylonians* and the *Assyrians* generally held that all creation had its origin in a shapeless chaos which moved in the beginning in primitive

darkness, and over which the goddess *Homorca* reigned in solitary grandeur. This chaos was supposed also to have been the abode of beasts and human beings of monstrous conformation.

After the lapse of some millions of years, *Belus* or *Baal*, the father of all, determined upon creating the world, and divided Homorca into two parts, which became the heaven and the earth. But this separation of her body caused the monsters of her former realm to die. Belus resolved then to create a race out of his own blood, and ordering some of the other gods to cut off his head, mixed the blood of his body with some earth, and made out of it the sun, moon, and stars, besides the five planets, and out of the residue men and animals. But mankind were still but little removed in intellect and manners from the lower creation. *Oanes* arose therefore out of the Red Sea, and came to Babylon in the shape of a large fish, with feet like those of men, and brought them laws for their government, and instructed them in manners, civilization, religion, arts, sciences, and trades. Every evening he returned into the sea, and every morning he appeared again and continued his labors.

Other sacred animals (*Annedati*) followed his example in instructing mankind, the last of which was the one generally called *Odacon.*

The twelve chief gods worshipped by the Babylonians, were said to have had their respective abodes in the twelve signs of the Zodiac. The best known to us were: *Salambo*, probably the goddess of the moon, during whose festival the slaves were waited upon by their masters; *Turrah*, the god of war; and *Derketo*, who was considered to have been the mother of Semiramis.

The worship of the Babylonians consisted in sacrifices and prayers offered up in temples, and in the celebration of festivals in honor of the gods. *Pl.* 11, *fig.* 1, represents two of the ancient Assyrians in the act of bringing their offerings to the altar in vessels suspended from long ribbons, probably priests. The two feet on the pedestal between them must have belonged to some idol-statue, the body of which was broken off.

The main feature in the system of idolatry of the ancient *Syrians* was the worship of animals; fishes and doves in particular received divine honors. The origin of this species of worship among the Syrians is related in the following myth. Once an immense egg fell down from heaven, and was caught by the fishes of the Euphrates, which carried it to the shore, where the doves hatched it. After a time the egg opened and a goddess of great beauty came forth, who has ever since been worshipped under the name of the "Syrian goddess" or *Astarte*, and sometimes also *Derketo.* The earliest representations make her appear as a woman, with fins and tail like a fish. Afterwards she was shown with a head-dress in the shape of the head of an ox. But the latest statues of her are often found to represent her as a beautiful woman, with a mural crown upon her head, a spindle in her hand, and the magic belt around her waist. A few of these attributes we have copied in *pl.* 11, *figs.* 3, *a*, *b*, from representations found upon ancient medals.

Another ancient Syrian idol is seen in *fig.* 2. It appears like a hale old

man with a long beard, his head covered with a cap curiously ornamented with figures, his right hand lifted up, and his left as if buried in the folds of his dress. His garment as well as the background is covered with a number of hieroglyphics, probably in explanation of the statue.

The *Phœnicians* believed that the breath of the supreme god *Colpiah* united with that of *Baau* (chaos) and produced the primitive matter, *Moth*. This gave birth in its turn first to the lower animals, and afterwards to rational beings (*Zophasemim*). After the creation of the living world, Moth assumed the form of an egg, from which sprang the sun, the moon, and the stars. Colpiah and Baau now united again, and produced *Protogonos* the firstborn and *Æon* (time), from whom all the generations and species of beings have sprung. Life was then infused into the dormant world, and the air, the ocean, and the earth separated into distinct elements, the winds began to blow, and the clouds to move, pouring down rain upon the earth, while the thunder awaking the echoes in the mountains roused also the slumbering animals into life, who now came forth out of the Moth.

The giants were afterwards called into existence, and were made of fire, light, and flame, the triad of the Egyptians. The first inhabitants of Byblos were said to have been the *Eluen* (the oak) and the *Beruth* (the pine). They had two children, *Uranos* and *Gæa*, who gave birth to four sons, *Ilos* or *Cronos*, *Bædylos*, *Dagon*, and *Atlas;* and three daughters, *Astarte*, *Rhea*, and *Dione*. Uranos, alarmed by a prophecy which predicted that his son Cronos would dethrone him, sought to kill his eldest born, but Cronos by the aid of the *Elohim* conquered his father, and then became himself the ruler of the universe.

Among the idols of the Phœnicians we mention the following as the most prominent: *Misor*, whose son *Taauth* or *Hermes* was the inventor of writing, and first instructor in all sciences; *Sydik*, the father of the *Cabires*, famed for medical knowledge, and the founder of civilization among men; and finally *Baal*, who is frequently spoken of in the Bible.

The chief temple of Baal was at Tyre, where he was worshipped as the god of the sun, and also as *Metcarth* (the Tyrian Hercules). But he was also worshipped throughout Assyria and Babylonia and in Carthage as the chief god. Jezebel, a Tyrian princess, and wife of Ahab, king of Israel, introduced his worship even among the Hebrews, but Jehu, a pious monarch, afterwards abolished the abomination.

The sacrifices offered up at the altar of this idol were generally oxen, but sometimes children were immolated at the shrine of his bull-headed image. This was done by first heating the hollow statue by a fire kindled in its interior, and then placing the infant in the extended arms of the monster. The altars were generally erected on high places; and the priests, dressed in crimson-colored garments, madly danced around the sacrifice, howling, and lacerating their bodies with sharp instruments.

But there are also other idols known by the name of Baal; these are distinguished from the one spoken of, by having distinctive appellations added to their names, *e. g.* *Baal-Zebub* (the god of flies), an idol at Ekron, who was thought to prevent the pestilence and the plague of flies from

afflicting the people; *Baal-Zamen*, a divinity worshipped by the Phœnicians as the god of heaven and of the sun. The discoveries made among the ruins of Palmyra brought to light, among other things, a temple of Baal, the best and most magnificent monument of antiquity found there.

The idols of the ancient Phœnicians were as grotesque and diversified as those of other eastern nations, as will be seen from the procession of the gods (*pl.* 11, *figs.* 5 *a*, *b*, *c*), which show that animals and parts of animals entered largely into the composition of their forms; for everywhere we meet with serpents' heads or tails, parts of fishes, or the heads of birds or beasts. *Fig.* 4 *b* represents one of the goddesses, whose name is not known; she has flame-like hair, surmounted by a crown in the shape of a star, and before her sits an eagle, with his head and eyes uplifted, as if watching her countenance. *Fig.* 4 *a* represents two other deities, standing by a palm tree. The bas-relief was found in the region of Palmyrene. One of them is dressed in a skirt which falls from the hips half way down to the knees; around the shoulders is a cloak, which appears to be thrown back; the head is ornamented with a flat crown, and the left hand armed with a club; behind the shoulders we see the crescent, which is probably a characteristic attribute. The other figure is that of a youth dressed in an under and upper garment, and holding a scroll in his left hand, which he seems to offer to his companion.

V. NORTHERN MYTHOLOGY.

To the descendant of the Anglo-Saxons, the northern mythology is peculiarly interesting. When he examines the religious poetry and the solemn rites of his forefathers, and enters into the peculiarities which distinguished their religion from that of all other nations of antiquity, he must feel proudly uplifted by the stern dignity that pervades their myths. Nowhere does he meet with the luxuriant allegories of the Grecian mythology, the adventures of Jupiter, or the intrigues of Juno; but everywhere an abundance of vigor, and the majesty of a deeply-rooted love of truth and honesty set forth in tales of surprising simplicity. It is true, the good is not entirely unalloyed by evil, yet the innate respect of the Northern people for virtue, veracity, and purity of heart, is predominant. It is evinced by the very simplicity and grandeur of the northern mythology, whose powerful and highly figurative poetry is unequalled by anything presented by other Pagan nations of antiquity.

The religion of the Scandinavians was at one time the prevailing belief of all the Germanic tribes that inhabited the shores of the Baltic and the Rhine, as well as that of the Francs and Westphalians. But when Norway was conquered in the ninth century, and the countries around it acknowledged the truth of Christianity, and the freest and proudest families saved their liberty and their faith by taking up their abode in Iceland, this country became properlv the home of their religion, and Icelandic poetry is

the richest source of authority on the subject. The Germanic, and particularly the Scandinavian nations were, more than many others, distinguished for possessing unusually athletic bodies, and an iron will, to strain every nerve in defence of their gods and their hearths. They were also renowned for their bravery and skill in all warlike exercises, while the name of a coward was considered the greatest stigma that could be affixed to any one; and these virtues and sentiments we see fully reflected in all their myths. The distinct features of the northern religion are most conveniently examined if we turn our attention separately to the religions of the Scandinavians proper (comprising the Danes, Swedes, and Norwegians), of the Germans, and of the Slavono-Vendic nations.

1. Scandinavian Mythology.

The first thing that deserves our particular notice in the Scandinavian system of religion is the lofty idea which it presents of the Supreme Being. Twelve names are given to him, some of which are: the One and Indivisible, the Creator, the Destroyer, the Eternal; but the one by which he is the most frequently called is *Alfadur*, the father of all.

This God and Creator dwelt high above all mundane affairs, and was not even approachable by worship; that was paid to inferior deities who presided over the temporal interests of man, and who were themselves mortal, and finally responsible to the Supreme Ruler, for their death was predicted to take place at the twilight of the gods, of which we shall speak more hereafter. The chief of these gods was *Odin*, who, though frequently called Alfadur, must be carefully distinguished from the Supreme Being, the uncreated God.

The cosmogony of this system is also on a grand scale; for we learn from the Edda, on the authority of the Voluspa, a very ancient and sacred poem, that, "In the beginning there was neither shore nor sea; the earth was not to be found below, nor in the expanse above; all was one vast abyss, in which a chaos reigned." To the north of this abyss was *Niffleheim* (the fog-world), a dreary region of mist and cold; and to the south, *Muspelheim* (the fire world), a world glowing and luminous, not to be dwelt in by any but the sons of fire. *Surtur* (the black) is its ruler; but *Niffleheim* is a world of icy coldness and full of gloom, and in its centre, beneath one of the roots of the ash tree *Yggdrasill*, is the spring *Hvergelmir*, which sends forth part of its waters in the *Elivanger*, that flow through *Helheim*, viz. the rivers of destruction, of howling, of roaring, of agony, &c. The world of fog is the abode of all who have died as cowards, or in any other disgraceful manner. The ruler of this dreary place is *Hela*, the daughter of *Loke* and *Angurbodi*, a monster of *Jotunheim*, who was hurled into *Niffleheim* by Odin, when Loke dared bring her to *Asgard*, the abode of the gods. Odin gave her power over nine of its worlds, into which she distributes those who are sent to her, that is to say, all those who die cravens, or through sickness or old age. Her domain is protected by very

high walls and strongly barred gates. *Misery* is her palace; *Hunger*, her table; *Starvation*, her knife; *Delay*, her waiter; *Sloth*, her maid; *Patience*, her threshold; *Sickness*, her bed; *Burning Anguish* and *Blasphemy*, its curtains. One half of the body is livid, and the other the color of human flesh; one side of her head is covered with hair, while the other, the livid side, is hideously bald, which contributes to increase the frightful appearance of her grim countenance.

Some of the waters flowed at one time so far from their source, that the poison which they contained became hard, and this was the origin of the ice, which now began to fill the dark abyss. But the ice was affected by the fiery vapors of *Muspelheim*, and the drops that fell from the melting mass formed themselves into the giant *Hymir*, who became the father of a new generation, and especially of all the giants that have ever since lived in the world. As he lay stretched out sleeping, his natural warmth brought forth a man and a woman from his armpits, and the contact of his two feet produced a son. These became afterwards the progenitors of a race called *Hrimthussar*, or frost giants. These giants were demi-gods, and nearly related to the gods of the first order, but were nevertheless their greatest enemies; for Hymir and his posterity had a great portion of the poison of the Elivanger in their bodies, and were therefore of a wicked disposition, and employed all their powers in efforts to injure the gods.

Besides Hymir there sprang also from the melted ice a wonderful cow, *Audhumbla*, whose milk, which flowed from her in four rivers, afforded nourishment and food to the giant. The cow supported herself by licking the hoarfrost and salt from the ice. But these rivers of milk were not the only wonderful production of this cow; for while she was one day licking the saltstones, there appeared at first the hair of a man, on the second day the whole head, and on the third the entire form endowed with beauty, agility, and power. This new being was a god who is called *Bure*, and became the father of *Bör*, who married *Belsta* the daughter of the giant *Belthorn*, by whom he had three sons, *Odin*, *Vile*, and *Ve*. These three now made war upon Hymir and slew him, and in the deluge caused by his blood as it flowed from his body all the giants were drowned except *Bergelmer* and his wife, who escaped in a boat. Odin and his brothers then commenced to create the visible world out of the body of the slain giant. They dragged the body of Hymir into the middle of the abyss, cut it in pieces, and formed out of the flesh the earth, his blood became the sea, his bones became mountains, his teeth rocks, his hair trees, his skull the arch of heaven, and his brain clouds pregnant with hail and snow. With his eyebrows the gods formed the castle *Midgard* (middle earth), destined to become the abode of man. The earth thus formed is round and flat, and the arched heaven above it is supported by four dwarfs called the *East*, *South*, *West*, and *North*. The sea forms a belt around the earth, and beyond this belt is the land of the giants.

But thick darkness still covered all the world created by the three brothers; to dispel which they gathered the sparks and beams that issued from Muspelheim and scattered them in the firmament to light the earth,

and they became stars. Odin then regulated the periods of day and night and the seasons, by placing in the heavens the two great luminaries, and appointing to them their respective courses. As soon as the sun began to shed its rays upon the cool earth, it caused the vegetable world to bud and sprout. Shortly after the gods had created the world, they walked by the side of the sea, pleased with their new work, but found that it was still incomplete, for it was without human beings.

They therefore took an ash-tree and made a man out of it; and they made a woman out of an alder, and called the man *Aske*, and the woman *Emla*. Odin then gave them life and soul, Vile reason and motion, and Ve bestowed upon them the senses, beautiful features, and speech. They were then perfect (*pl.* 13, *fig.* 8). Midgard was then given to them by the gods as their residence, and they became the progenitors of the whole human race.

The mighty ash-tree *Yggdrasill* (*pl.* 12, *fig.* 6), was supposed to support the whole universe. It had sprung from the body of Hymir, and had three immense roots extending, one into *Asgard* (the dwelling of the gods), the other into *Jotunheim* (the abode of the giants), and the third to *Niffleheim* (the regions of darkness and cold). By the side of each of these roots is a spring from which it is watered; the root that extends into Asgard is carefully tended by the three *Norns*, *Urdur* (the past), *Verdandi* (the present), *Skuld* (the future). The spring at the Jotunheim side is Hymir's well, in which wisdom and wit lie hidden, but that of Niffleheim, which is called *Hvergelmir* (the old goblet) feeds the adder *Nidhögge* (darkness), which perpetually gnaws at the root. The branches of this tree spread over the whole world, and reach even above heaven. An eagle is perched upon them, which knows many things (between his eyes sits sometimes the hawk called *Vederfölnir*); the squirrel *Ratatösk* runs up and down the ash, fanning strife between the eagle and the Nidhögge, by whispering to the one what the other says. Four harts run across the branches of the tree and bite the buds; they are called *Dainn*, *Dvalinn*, *Duneyr*, and *Durathror*, and represents the four winds. Under the tree lies Hymir; when he tries to shake off its weight the earth quakes.

Asgard is the name of the abode of the gods, access to which is only gained by crossing the bridge *Bifröst* (the rainbow). On one end of this bridge is a citadel in which dwells the warden appointed by the gods to watch without ceasing that no enemy cross or even approach it. Asgard itself consists of golden and silver palaces, the dwellings of the gods; but the most beautiful of these is *Valhalla*, the residence of *Odin* and some other deities. It is an immense building of solid gold, with 540 gates. It fronts the rising sun, and is surrounded by the magnificent grove *Gladsheim* (home of joy), all the trees of which bear golden leaves. Its splendid halls are the reception rooms where Odin welcomes the spirits of heroes slain in battle, and hails them *Einheriar* (chosen heroes). Here they are then made to enjoy unalloyed and uninterrupted pleasures. Every morning they are roused from sleep by the crowing of the cock with a golden crest, when they arm themselves and go to *Odin's Tuum* (the court of Odin), where they fight until the hour of

repast; then they return to Odin's hall with their wounds all healed, and enjoy the sumptuous feast daily spread for them. This banquet consists of the flesh of the boar *Seremnir*, which is always sufficient in supply, no matter how great the number of the guests may be. Every day it is served up at table, and every day are its life and flesh renewed. Their drink is mead, the milk of the goat *Heithrun*, which stands upon the walls of Valhalla, and feeds on the foliage of the tree *Lerad*, which grows upon the hall of the dead; this beverage is served to them in abundance by the *Valkyræ*, beautiful maidens of whom we shall speak hereafter. Before we leave the hall of Odin, we must also notice the wonderful stag *Eikthyrnir*, from whose horns the waters of the spring *Hvergelmir* gush forth.

But this scene of fierce contest was not the only heaven of which the northern nations had an idea. We learn from the Voluspa, that beyond the clear blue ether there is another heaven called the boundless, in which is situated the glorious city *Gimble*, the eternal and unchangeable. At the final day of judgment, the dwellers of Valhalla, Niffleheim, and Midgard, will have to stand forth and be tried, no longer by the rule of warlike achievements, but by that of moral justice. Those who, however unwarlike, have been good and just, will then be admitted to the glories of Gimble and the presence of the Supreme Being; while those who, though valiant, have been cruel, unjust, and rapacious, will be hurled down to *Nastrond* (the bleak shore of the dead).

In the meantime all who die by old age or disease, and all cowards and fugitives in battle, will have to suffer in *Helheim*, a province of Niffleheim, which is girt by the hell-stream *Gjöll*, and set apart as the abode of the unblest.

The Gods of the Scandinavians. The Supreme Being, the uncreated one, we have already said was not considered an object of the religious worship of mortal beings. They honored therefore in this way the created gods, the chief of whom was *Odin*. He was originally the sun considered as a deity, and also its symbol. As the ruler of the world, and king of gods and men, he occupies the chief seat at the banquet of the gods of Valhalla, upon his throne, from which he can overlook all heaven and earth.

Upon his shoulders are the ravens *Hugin* and *Munin*, who fly every day over the whole world, and on their return report to him all they have seen and heard. As the god of the sun, he has the disk of that luminary behind his head, supported by two serpents (*pl.* 11, *fig.* 6). In his right hand he holds a spear, and by his side is the sword, attributes which designate him as the ruler of battles, and source of all valor. The tablet in his left hand he holds as the inventor of the Runic characters and songs of enchantment. *Pl.* 13, *fig.* 1, we see him standing with the left foot on a stone; around his shoulders is the warrior's cloak over a splendid cuirass, and upon his head a golden helmet; his left hand grasps the shield, and with his right he is leaning upon the sword. The two ravens before mentioned are perched upon his shoulders, and at his feet lie the two wolves *Geri* and *Freki*, to whom he gives all the meat placed before him at every banquet, while he himself lives only on the wine which he drinks.

There are a few representations of him, which we give in *pl.* 11, *figs.* 7–10, but they are much more imperfect. In the two first we see his garments covered with Runic characters. These runes were the written letters of the ancient Scandinavians, and consisted chiefly of oblique lines placed upon a perpendicular one, so that their individual character and meaning had to be determined by their number and direction. The well known runic stones (*figs.* 17 and 18) had generally a border in the shape of two intertwined serpents, whose bodies were covered with these lines. They were used either as tombstones, monuments, genealogical registers, or records of treaties. The runic calendar (*fig.* 19) is covered with the same kind of characters.

Vile and *Ve*, the brothers of Odin, who assisted him in the creation of the world, are not afterwards mentioned in the Edda, and appear never to have been objects of worship.

Thor, the god of thunder, the most powerful warrior, and the oldest son of *Odin* and *Frigga*, was the first in rank after Odin. He was called *Asa Thor* (the lord Thor). His splendid palace, situated in the air, had in it 540 halls, and was called *Bilskirnir.* He is represented (*pl.* 13, *fig.* 2) seated on an iron chariot (the rolling of which causes the thunder) drawn by two wild goats. Hence his other name *Auka Thor* (the driving Thor). His attributes are the three precious presents which he received, and which make him powerful and feared, namely: in his right hand the hammer *Mjölnir* with the short handle, which, when hurled against his enemies, not only kills, but returns also to his hand of its own accord; it was also sometimes used to bless the marriage tie. Around his body is the belt of prowess, *Megingiadir*, which increases his strength twofold; and upon his hands are the enchanted iron gloves, which enable him to handle his hammer with greater efficacy. On account of his influence and power he is also seen (*pl.* 11, *fig.* 6) at the right hand of Odin when the latter is seated on his throne. The hammer in his hand he wields as a symbol of lightning.

Tyr, another son of Odin, is the god of battle-fields. He is the protector and friend of all heroes who combat one another in open and honest fight, for he himself is without guile or deceit. He is generally represented (*pl.* 13, *fig.* 6) as a powerful-looking man in the vigor of life, with a cuirass-like tunic, and the warrior's cloak thrown over his shoulders, a helmet upon his head, the lance in his right hand, and the buckler by his side. Behind him lies the ram. He is distinguished for courage and boldness, and was therefore appointed to feed the terrible wolf *Fenris*, who has such enormous jaws that when he opens them his nose touches the heavens, and he displays teeth so large that the highest towers would seem small by their side. Tyr's fearless courage caused him afterwards to lose his right hand by means of this wolf. The myth which relates the circumstance tells us, that the wolf Fenris was a son of *Loke*, and then continues. When the gods who raised the monster saw how rapidly he grew in size and strength, and moreover knew that he would at a future period prove fatal to them, they attempted to chain him, but he broke the strongest fetters as if they were made of cobwebs.

The gods despairing that they would ever find a chain strong enough to fetter Fenris, sent a messenger to the mountain spirits (*Svartalfir*) in *Svartalfaheim*, who made for them the chain called *Gleipnir* (the Devouring). It was fashioned of six things; viz. the noise made by the footfall of a cat, the beards of women, the roots of mountains, the breath of fish, the sinews of bears, and the spittle of birds; when finished, it was as smooth and soft as a silken string. But when the gods asked the wolf to suffer himself to be bound with this apparently slight ribbon, he suspected their design, fearing that it was made by enchantment; he therefore only consented to be bound with it upon condition that one of the gods put his hand in his mouth as a pledge that the band was to be removed again. Tyr alone had courage enough to do this. But when the wolf found that he could not break his fetters, and that the gods would not release him, he bit off the hand of Tyr, who has ever since remained one-handed.

Braga, another son of Odin (*pl.* 12, *fig.* 2), is represented as a man advanced in years, and playing on a harp; he was the god of elocution, oratory, poetry, and song, and was distinguished above all the other gods for his wisdom and penetration. His tongue was covered with runes of enchantment, symbolizing that his song records great deeds. He is, therefore, in modern literature, often regarded as the god of history.

The warden of Asgard, who lived in the celestial citadel at one end of the bridge Biförst, which he guards against the giants, was *Heimdall*, or *Heimdallur* (*fig.* 5); he is represented mounted upon his steed *Gulltoppur* (Goldenmane), blowing his trumpet *Giallarhorn* (the far-sounding), the sound of which can be heard throughout the universe, and which he only blows to call the gods and heroes to the rescue when danger threatens. He also was a son of Odin; but the gifts bestowed upon him by his nine mothers were the coolness of the ocean, the strength of the earth, and a blood of reconciliation. He was particularly and in an extraordinary manner qualified for his post; "for he sleeps," says the Edda, "less than a bird, can see a hundred leagues by night or day, and so acute is his sense of hearing, that he hears the grass grow in the earth and the wool on the sheep's back, and a wound from his sword is always fatal." His nine mothers were the nine hours of night, begetting the dawn, and he was himself the symbol of the brightness of early morning, which favors virtue and opposes vice.

Odin's messenger to transmit all his orders and resolutions was his son *Hermode*, also the protector of travellers. On *pl.* 13, *fig.* 7, we see him dressed in a cuirass, and with a helmet upon his head, both presents from Odin. He acted also as master of ceremonies with his brother Braga, whose duty it was to welcome the newly slain heroes on their entrance into Valhalla.

Besides those already mentioned, there are two other gods that belong to the same class, who have the collective name *Asir; Vidar*, the god of silence, and *Vali*, the god of spring, concord, and reconciliation.

The goddesses of this race were *Frigga*, *Idunna*, *Gefion*, *Fylla*, and *Sif*.

Frigga was the wife of Odin, and granted growth and fruitfulness to all living things. She presided in all the assemblies of the goddesses, which

were always held in her palace *Vingolf*. She knew, also, the fate of all men, but never revealed it to any one. She understood, moreover, the language of all animals and plants. Her wisdom and knowledge were so great, that even Odin applied to her often for counsel. She is generally represented as in *pl.* 12, *fig.* 1, seated in a golden chariot, which is drawn by two white cats, her white veil is flying in the wind, and by her side hover two of her attendants with veils similar to her own.

Idunna was the wife of Braga, and the goddess of immortality. She is always found as in *fig.* 3, seated by the side of her husband, with a basket of apples in her lap, which the gods eat when they begin to grow old, in order to renew their youth, and which are given to the Einheriar to make them immortal. The myth relates of her, that she was once carried off by the powerful giant *Thiasso*, who was assisted in this abduction by *Loke*, that most crafty of the gods. When the gods were thus deprived of the youth-giving apples, they visibly began to grow old. Alarmed at this state of things, they threatened Loke, who confessed his guilt, and promised to bring her back if the queen of the gods, Frigga, would change him into a falcon, and endow him with the power to transform himself and others into any shape he pleased. The request was granted, and he transported himself immediately to the abode of the giant, where he arrived just as the other had gone on a fishing excursion, accompanied by all his servants. He entered the window in the shape of a falcon, and seating himself on the shoulder of the goddess, communicated to her his errand, and changing her into a swallow, flew with her towards Asgard.

The giant, who returned just in time to witness their escape, immediately pursued them in the shape of an eagle, but they reached Asgard before he could come up with them. Loke, afraid of his pursuer, hid himself beneath a pile of branches just as the eagle was about to dart upon him, but the gods set fire to the pile, which singed the wings of the eagle so badly, that he fell down, when he was readily destroyed. But Idunna's arrival was hailed with great demonstrations of joy.

Gefion was the goddess of innocence, and the protectress of pious virgins. *Fylla* was the confidential attendant and counsellor of Frigga; and *Sif*, the wife of Thor.

The gods belonging to the second class were the *Vanir*, and such of them as were afterwards adopted by the Asir. The Vanir were a race who inhabited the regions of the ether which stretched over *Godheim* (Asgard). They were always friendly disposed to the human race, and protected it even against any injustice perpetrated by the gods against any individual of the race, or avenged it when protection came too late. When Odin had once unjustly killed a man, the Vanir took up the cause, and stormed Asgard; a battle ensued, but as neither side could gain a victory they made peace, and ratified it by spitting in a large vessel. The saliva thus collected gave birth to a wonderful being *Quasir*, who was endowed with supernatural wisdom, and travelled through the world for the purpose of instructing mankind. At last the dwarfs *Fialar* and *Galar* killed him, and collecting his blood in two tubs and a large kettle they mixed honey with it. This mix-

ture soon became a mead, the drinking of which made sages and poets. To the gods they reported that they had found Quasir strangled by his own wisdom. But some time afterwards they killed a giant also; his son avenged the death of his father by placing them upon a rock in the sea, and threatened that he would not release them until they had given him the precious mead. Fear at last overcame avarice, and they yielded to him their treasure. He concealed it in the *Guitberg;* but Odin having bored a hole in the rock, entered through it in the shape of a worm and drank all the mead in the three vessels, and then escaped in the shape of an eagle.

The giant discovered the theft, pursued him in a like form, and caught the god above Asgard. A terrible fight took place, and Odin, in order to relieve himself, disgorged all the mead, which was caught by the gods below in a number of small vessels.

When the Asir and Vanir had ratified the peace above mentioned, they also exchanged hostages. The Asir gave to the Vanir *Hönir* and his companion *Mimir*, and the Vanir left with the Asir *Njord*, and his two children, *Freyr* and *Freya*, who were adopted by their new associates.

Njord, or Njördr, was the god of the winds, the giver of rain, and had the power to still the agitated waves of the ocean and to quench the fire. He was the patron god of sailors, fishermen, and hunters, and received with particular favor the offerings of travellers. Even temples and sacrificial places were considered under his especial care. His palace *Noadun* is the eleventh of the palaces in Asgard. He is represented (*pl.* 13, *fig.* 5) dressed in an ample garment, with wings upon his shoulders, and long and dishevelled hair on his head; in his right hand he holds the oar, and in his left the bow, while a net is at his feet.

Freyr, his son, is the god of the sun, of fruitfulness, and rain; his aid was always implored when men wished to obtain a favorable season or peace. He was considered kindly disposed towards mankind and willing to grant their prayers. He is represented (*fig.* 3) with a halo around his head, in his left hand holding a number of ears of wheat, and with his right an urn from which the water flows; as the god of the sun, he has the golden boar *Gullinbursti* lying at his feet. His dwelling is in *Alfheim*. Sometimes he is also found standing on the left of Odin (*pl.* 11, *fig.* 6).

The myth tells us of him that he once seated himself upon the vacant throne of Odin, from which, as has been said, one could see everything in the whole world. Casting his eyes around he saw in the high north in the land of the giants, the beautiful *Gerda*, daughter of *Gymir*, and fell immediately so deeply in love with her that it affected his health, so that he could neither eat, drink, nor sleep. His parents were very much afflicted at the condition of their child, and made his servant *Skyrnir* ascertain the cause. When they learned it, they charged the faithful attendant with the task of demanding her in marriage for their son. After much trouble and overcoming many obstacles, Skyrnir succeeded and Gerda became Freyr's wife.

Freya, the sister of Freyr, was the goddess of love and also goddess of the moon. She was next to Frigga the most powerful and honored, the

most beautiful, virtuous, and gentle of all the goddesses, ever ready to grant the prayer and petitions of man.

She loved music, spring, and flowers, and was particularly fond of the *Elves* (fairies). The Scalds also drew their inspiration for their love songs from her. Her husband *Odur* left her and travelled into distant countries; when she found after some time that he did not return, she went in search of him, but without success. She began therefore to lament and weep her loss; but her tears became gold and her lamentation the sweetest melodies. She is always described as attended by two of her maids (*pl.* 13, *fig.* 4).

The strangest figure in the whole circle of Scandinavian gods is *Loke*, the ever fickle, the disturbing element. He is the symbol of the resisting force in the material world against the laws of nature, the embodiment of that wild, unruly recklessness which breaks down all barriers that will yield to its strength. In the spiritual world he represents arbitrariness, untruth, falsehood, frivolity, impudence, sin, and generally all evil in the world arising from its compound nature of spirit and matter.

Locke or *Loke*, for he is called by either name, was the son of the giant *Farbauti*, and surpassed most created beings in beauty, skill, agility, as well as in craftiness and perfidy. He appeared as if belonging neither to heaven nor to hell, but partaking of the virtues of the one and vices of the other. He remained on indifferently good terms with the gods, into the company of whom he had forced himself, and he delighted equally in bringing them into difficulties and in extricating them again out of the danger by his cunning, wit, and skill. His greatest crime was the plan which he devised and which resulted in the death of *Baldur*, the best and most beloved of the gods.

This Baldur was a son of Odin and Frigga, and is described in the Edda as "so fair and dazzling in favor and features, that rays of light seem to issue from him, and of so fair a head that the whitest of all plants is called Baldur's brow. Baldur is, moreover, the mildest, wisest, and the most eloquent of the Asir, yet such is his nature that the judgment he has pronounced can never be altered." For a long time he lived in happiness by the side of his wife *Nana* in his splendid palace *Breidablik* (far shining splendor) until he dreamed one night that his life was in danger. Disturbed by this dream he related it to the gods. His mother, who became alarmed, sought to prevent all danger by making everything animate or inanimate, fire, water, earth, animals, stones, trees, and reptiles, take an oath that they would not hurt him. Baldur being now thought invulnerable, the gods amused themselves by making him a target at which they discharged arrows, stones, and swords, without occasioning him any injury, all things that had taken the oath being mindful not to hurt him. But Loke, who hated and envied this pure being, was hatching a malicious trick. Disguised as an old woman he elicited from Frigga the avowal that, deeming the mistletoe too weak and insignificant to do harm, she had omitted to take the oath from it. Loke immediately went in search of the mistletoe, which he found and returned with it to the assembly. He now persuaded *Hödur*, who was blind, and had taken no part in the sport, to

hurl the shrub against Baldur, offering to direct his hand. Hödur, ignorant of the nature of the weapon, consented and threw the mistletoe against Baldur, who, to the consternation of all the gods, immediately fell dead.

The grief of the celestials was so great that it deprived them at first of all courage and even speech, for the oracle had predicted that the death of their favorite threatened all with destruction. All the gods and even some of the giants united in burning his remains with great pomp on a funeral pyre. His wife, who died of grief, and his horse were buried with him.

After a fruitless attempt to restore him to life Frigga sent *Hermode* the messenger to entreat *Hela*, the queen of the lower world, to allow the latter to return, assuring her that he was beloved by all things. "Well," replied Hela, "if all things in the world, both living and lifeless, weep for him then shall he return to the Asir, but if one thing speak against him or refuse to weep, he must be kept in *Helheim*." When Hermode had returned with this answer from Hela, the gods sent messengers out into all the world requesting all created things to weep for Baldur's death, and all, even the inanimate things, wept. Only one old witch who was found in a cave shed no tears and refused to do it; this witch was Loke in disguise. Baldur had, therefore, to remain among the dead. But Loke did not escape his well deserved punishment. When he perceived how exasperated the gods were he fled to the top of a mountain. There he built a house with four doors so that he could see every approaching danger. Frequently he changed himself into a salmon and hid among the stones of a neighboring waterfall. But the Asir caught him in a net, and then took the intestines of his son *Nari*, who had been torn to pieces by his brother *Vali*, whom the gods had changed into a wolf, and with them they bound Loke to the points of three rocks, and afterwards transformed these cords into thongs of iron. *Skadi*, the goddess of the chase, then suspended a serpent over him in such a manner that the venom fell on his face drop by drop. *Sigyn* his wife stands by him and receives the drops as they fall in a cup; but when she carries it away to empty it of its contents, the venom falls upon Loke, which makes him howl with horror and twist his body about so violently that the whole earth shakes, and this produces what men call earthquakes. In this condition will he remain until *Ragnaroek* (the twilight of the gods), which is the end of the world, when in the war of extermination Loke will fall simultaneously with his antagonist Heimdall. The lower portion of *pl.* 11, *fig.* 6, is intended to represent Loke suffering the punishment of his crime.

Fig. 11 is a front and back view of an idol lately found in Norway; but little is known about it.

Among the lower goddesses, though not exactly goddesses themselves, we must also enumerate the *Norns* already mentioned above (*pl.* 12, *fig.* 6). They were the dispensers of the unchangeable fate to which gods and men had alike to bow, and were as such looked up to with awe and reverence. The first, *Urdur* (the past), was of the race of the giants; the second, *Verandi* (the present), belonged to the Asir; and the third, *Sculd* (the future), to the Vanir.

Their chief occupation consisted, as we have already said, in taking care of the tree Yggdrasill, and seeing that its root was duly watered; they had, besides, to engrave the runes of fate upon a metal shield, for by these runes was the lot of every living being decided. But they were always just, impartial, and unchangeable, and none of their decrees could ever be altered.

Next to these in rank are the *Valkyræ*, or *Valkyryor* (*pl.* 12, *fig.* 7). They were warlike virgins, mounted upon horses, and armed with helmets, shields, and spears. Odin, who was desirous to collect a great many heroes in Valhalla, in order to have a numerous host of warriors when at the Ragnaroek he would be compelled to meet the giants in battle, sent down to every battle-field to make choice of those who were to be slain, and to sway the victory. Hence their name, which is composed of *Val*, a battle-field, and *kyra*, to choose, *the electors of the battle-field*. Their presence was known by a strange flickering light, like that of the Aurora Borealis, and every hero was rejoiced at the prospect of being called by the Valkyræ to take a place in Odin's hall. In Valhalla these virgins had the office of waiting upon the banqueting heroes, and of foretasting their mead. Every time these maidens rode through the air they filled it with the rays of light which streamed from their spears, and from the manes of their horses dew dropped into the valleys, and hail fell upon the woods. Their number is not mentioned, and only two are particularly distinguished, viz. *Hrist* and *Mirst*, who were the exclusive cup-bearers to Odin.

The Edda mentions also another class of beings inferior to the gods, but still possessed of great power; these were called the *Elves*, or *Alfs*. The white spirits, or *Elves of Light*, were exceedingly fair, more brilliant than the sun, and clad in garments of a delicate and transparent texture. They loved the light, were kindly disposed to mankind, and generally appeared as fair and lovely children. Their country was called *Alfheim*, and was the domain of *Freyr*, the god of the sun, in whose light they were always sporting.

The black or night-elves, *Svartalfs*, were a different kind of creatures. Ugly, long-nosed dwarfs, of a dirty brown color, they appeared only at night, for they shunned the sun as their most deadly enemy, because whenever his beams fell upon any of them, they changed them immediately into stones. Their language was the echo of solitudes, and their dwelling-places in subterranean caves and clefts, which were called *Svartalfaheim*. They were probably the dwarfs who came at first into existence as maggots produced by the decaying flesh of Hymir's corpse, and were afterwards endowed by the gods with a human form and great understanding. They were particularly distinguished for a knowledge of the mysterious powers of nature, and for the runes which they carved and explained. They were the most skilful artificers of all created beings, and worked in metals and in wood. Among their most noted works were Thor's hammer, and the ship *Skidbladnir*, which they gave to *Freyr*, and which was so large that it could contain all the Asir with their war and household implements, but so skilfully was it wrought, that when folded together it could be put into a side pocket.

The *Giants*, who were the natural enemies of the gods, were divided into several races, all of which traced their common origin to the *Hrimthussir* (the frost-giants). They were said to be uncouth in form, furnished with a number of arms and heads, some having as many as a hundred of each; but they were possessed of great riches. They possessed a greater knowledge than most of the Asir of the past, of the wisdom gained from the runes, and of witchcraft. Their world was *Jotunheim*, a region situated near the borders of the earth, where they had a kind of capital called *Utgard*, the residence of their king *Utgardloke*, from whom the above-mentioned wicked Loke was distinguished by the epithet *Asa Loke*.

The character of this giant-king of Utgard best appears in the myth of Thor's adventures on his journey to Utgard. As soon as the god of thunder obtained his wonderful hammer *Mjölnir*, he determined to go out in search of adventures, and try the virtues of his new weapon. Accompanied by *Loke* and *Thialfi*, his friend and companion, noted for his swiftness in running, he determined to visit Utgardloke.

As soon as the three reached Jotunheim they entered a large wood, and night having come on, looked around for a place to sleep: at last they discovered a hut in which they passed the night. But their rest was several times disturbed by a noise which they thought was caused by an earthquake. When morning came they discovered that what they had taken to be an earthquake was only the snoring of an immense giant, who had slept near their hut. Just as Thor was about to try the virtue of his hammer upon the head of the sleeper he awoke, and looked about for his glove, which he had lost the previous day; after a brief search he found it and picked it up. Then only did Thor find out that this was the hut, or what they had taken for one, in which they had spent the night. The giant now offered them his company and services as a guide, which they accepted. The four then pursued their journey together. When the evening came again their new companion offered them his basket with provisions to supply themselves with supper, but requested that they would be careful with the cord wound round the basket, for he had no other to fasten it with. After he had given this injunction he lay down and was soon fast asleep. When Thor tried to open the basket he could not untie a single knot, nor render a single string looser than it was before. Seeing that his labor was in vain he became wroth, and grasping his mallet with both hands launched it at the giant's head. *Skyrmir*, for so he had called himself, awoke and merely asked if a leaf had not fallen on his head. About midnight he commenced again to snore so loud that it sounded like distant thunder. Then Thor arose and again took his mallet and launched it with redoubled force on the giant's forehead. Skyrmir awaking, said an acorn must have fallen on his head, and then composed himself again to sleep. A little before daybreak when the enraged god perceived that the giant was again asleep, he seized for the third time the terrible Mjölnir, and concentrating all his strength, threw the mallet with such violence that it forced its way up to the handle into the sleeper's temple. But Skyrmir arose grumbling and said it was not pleasant to sleep in this wood, for just now a branch of a tree had fallen on his

head. He then left them, and they pursued their journey, until they came to Utgardloke's palace. The king returned their respectful salutations with contempt, and asked them to give his people some proofs of their boasted strength and skill. *Loke* immediately offered to eat the greatest amount placed before him quicker than any one else. Utgardloke then ordered one of his men who was sitting at the further end of the bench, and whose name was *Logi*, to come forward and try his skill with Loke. A trough filled with meat having been set on the hall floor, each placing himself at one end began to eat as fast as he could, until they met in the middle of the trough. But it was found that Loke had only eaten the flesh, whereas his adversary had devoured both flesh and bone, and the trough to boot. All the company therefore adjudged that Loke was vanquished. *Thialfi* now proposed that he would run a race with any one who might be matched against him. The king called a young man named *Hugi* and bade him run a race with Thialfi. But in each of the three courses which they ran Hugi so far outstripped his competitor that Thialfi himself confessed that he had lost the race. Thor then offered to drink against any one. His host immediately ordered his cup-bearer to bring the large horn which his best companions were wont to empty at a draught at his feasts. The cup having been brought he handed it to Thor, saying, "Whoever is a good drinker will empty that horn at a single draught, though some men make two of it, but the most puny drinker can do it in three." But Thor attempted in vain to accomplish the feat: even after the third draught he found that the liquor was only a little lower in the horn.

Full of wrath at this defeat, he now challenged the giants to select any one among them to meet him in a trial of strength. To which Utgard-Loke replied: "We have a very trifling game here, in which we exercise none but children. It consists merely in lifting my cat from the ground, nor should I have dared to mention such a feat to *Asa Thor*, if I had not already observed that thou art by no means what we took thee for." Stung to the quick by this taunt, Thor seized the cat, but with all his strength succeeded only in making her lift one foot from the ground. Twice baffled, the Thunderer now exclaimed: "Little as ye think me, let me see who amongst you will come hither, now I am in wrath, and wrestle with me." To which the king replied that he knew no one who would not think it beneath him to do so; but if Thor was so anxious to show his prowess, to come forward and wrestle with the old nurse *Elli*, who presented herself at the same time. But so far from his throwing her down at once, which he at first thought he could do without much effort, she succeeded in bringing him down upon one knee, and was therefore declared the winner. Displeased at these failures, Asa Thor departed with his companions from the city of the giants. Utgardloke led them to the gate, and before parting he said to him: "Nay, thou needst not be astonished at having been vanquished in all these contests; for *Logi*, the competitor of Loke, was the all-devouring fire; *Hugi*, who won the race with Thialfi, was Thought, and it is impossible to keep pace with that. One end of the horn, which thou didst try to empty, reached the sea; when thou comest to its shore thou wilt

perceive how much it has sunk by thy draughts. The cat was the *Midgard serpent*, whose body encompasses the ocean; when we saw that one of his paws was off the floor, we were terror-stricken, for he was then only long enough to inclose the waters between his teeth and tail. The wrestling with *Elli* was also a wonderful feat, for she is Old Age, and there was never yet any one whom she will not sooner or later lay low if he abide her coming. And I was the first giant who met thee in the forest, for the purpose of frightening thee from coming here. Mayest thou never return any more!" When Thor heard this he raised his mallet to kill the king of the giants, but the latter had already vanished, and with him the city of Utgard. The three travellers saw nothing but a beautiful plain. They then returned to Asgard to plan another expedition.

It was a firm belief of the northern nations, and a prominent article of their creed, that a time would come when all the visible creation, the gods of *Valhalla* and *Niffleheim*, the inhabitants of *Jotunheim*, *Alfheim*, and *Midgard*, together with their habitations, would be destroyed. This we have already mentioned as the end of Loke's sufferings, *Ragnaroek*, the Twilight of the gods. The Asir themselves were the first cause of the calamity; for by making peace with the giants, and admitting the wicked Loke into their society, as well as by their intermarriages with the daughters of the giants, they introduced wickedness into the region of bliss, and incurred the penalty which sooner or later must overtake it. The fearful day of final retribution will not, however, be without its forerunners. The gods themselves having ceased to be what they were, the purity of their race will have departed, and craft and injustice begin to characterize their deeds.

Wickedness having increased everywhere, the race of the giants will once more rule with power and might. Then comes the beginning of this fearful period. It will open with the dreadful *Fimbulvetur*, a triple winter, during which snow will fall from the four corners of the heavens, the frost be very severe, the wind piercing, the weather tempestuous, and the sun impart no gladness. Three such winters will pass away without being tempered by a single summer. Three other similar winters will then follow, during which war and discord will spread over the universe. Brethren, parents, and children, for the sake of mere gain, will kill each other, and no one spare a human being no matter what the tie of relationship. The earth itself will be frightened and begin to tremble, the trees will be torn up by the roots, the sea leave its basin, the heavens tear asunder, and men fall in numbers victims to death's arrows, while the eagles of the air feast upon their still quivering bodies. The wolf *Fenris*, now become aware that his time has come, will break his bands, and the *Midgard serpent* will rise out of her bed in the sea, and fill the atmosphere with her poisonous breath. *Loke*, too, released from his bonds, will join the enemies of the gods. Amidst this general devastation, the sons of *Muspelheim* will rush forth under their leader *Surtur*, before and behind whom are flames and burning fire. His sword outshines the sun itself. Onward they ride over *Bifrost*, the rainbow bridge, which breaks under the horses' hoofs; but they, disregarding its fall, direct their course to the battle-field called *Vigrid*. Thither also repair the

wolf Fenris, the Midgard serpent, Loke with all the followers of *Hela*, and *Hrym* with his *Hrymthussir*.

Heimdall now stands up, and with all his force sounds the *Gjallar-horn* to assemble the gods and heroes for the contest. The Asir thus summoned advance led on by *Odin*, who is armed with his spear *Gungnir*, and wears his golden helmet and refulgent cuirass. A battle now commences, such as was never before seen, nor will ever have its equal. *Odin* engages the wolf *Fenris*, who devours him; but at that instant his son *Vidar* advances, and setting his foot on the monster's lower jaw, seizes the other with his hands and tears them asunder; the wolf dies, and Vidar has avenged the death of his father. *Thor* gains great renown for killing the *Midgard serpent*, but recoils at the same time and falls dead, suffocated with the venom which the dying monster vomits over him. The dog of hell *Garm*, who has broken loose from the *Gnipa cave*, attacks *Tyr*, and they kill each other. Loke and Heimdall meet and fight until they are both slain.

The Asir and their enemies having fallen in battle, *Surtur*, who has killed *Freyr*, darts fire and flames over the world, and the whole universe is burning and consuming. The sun becomes dim with smoke, the earth sinks into the ocean, the stars fall from heaven, and time is no more.

After this *Alfadur*, the eternal and uncreated god, will cause a new heaven and a new earth to arise out of the sea, where the gods and men will live happily together. The new earth, filled with abundant supplies, will spontaneously produce its fruits without requiring labor or toil. Neither will wickedness or misery any more mar the happiness of its inhabitants, who will live amidst scenes of uninterrupted bliss, innocence, and joy.

Before we close this section we will make a few remarks on the worship and religious ceremonies of the Scandinavians.

Their priests were called *Blodgodar* or *Blodmen*, and their high priests *Höfdingi*. They were all divided into different classes according to their respective ranks.

We read also of priestesses, *Blodgydiur*, who lived in separate dwellings which were considered sacred, and were an asylum, particularly for persecuted virgins.

These priestesses were only in the service of the goddesses, but officiated also at the worship of *Baldur*.

The chief business of the priesthood was to consult the oracles, to predict future events, and to superintend the ceremonies of enchantments. Their soothsaying was termed *Seid*.

The Scandinavians had no temples; for, holding that the gods could not be inclosed in walls, they erected their altars in sacred groves or on eminences, and sometimes inclosed them with a hedge. Public opinion alone invested them with a character of sanctity. The ring worn by the priest when offering the sacrifice was always kept upon the altar, and upon it every one placed his hand who was about taking a solemn oath. Sacrifices of men or animals constituted the chief feature of their worship.

They had several religious festivals, of which we mention two which were considered the most important. The annual chief festival, or *Yule*, which

was celebrated on the 21st of December with many imposing ceremonies, one of which was accompanied by the sacrifice of a boar in honor of *Freyr*, the god of the sun. The other was the Novennial, which was the greatest festival of the nation, in the celebration of which all the inhabitants were required to join.

It lasted nine days, during which time they sacrificed many animals, and each day a human being. The blood of the victims was offered as an atonement to the gods, and their bodies were hung upon the branches of the trees in the sacred grove. Kings and nations sent offerings and presents for this festival, to Upsala, the capital.

2. German Mythology.

The religion of the ancient Germans is much less known in its details than that of the more northern nations of Europe. There is no doubt that its general features were the same as those which characterize the religion of the Scandinavians. The same gods were worshipped, only under different names and with different ceremonies.

It is probable that the primitive Germans paid divine honors to the earth, fire, and the celestial bodies. The St. John's fire, which was kept up for a long time after the introduction of Christianity, and which is still to be met with in some sequestered spots of the country, is very likely a remnant of the old fire-worship. They did not, however, regard fire as a god, but only as a symbol of the Almighty Being, whom they adored with profound reverence without presuming to name him or worship him in temples. Before no visible being were they willing to bend the knee, for they acknowledged no one as master except the invisible Lord of the universe.

Only at a later period, when the nation had been already divided into regular tribes, and had learned to look up to a superior of their own race, do we find the idea of a god with characteristics more within the scope of the human imagination, develop itself in the popular belief. This god and king, who was also considered the father of the nation, they called *Thuisco*, *Teut*, or *Theut*. But the race of gods of which he was the chief had to share the same fate with the ancient gods of Scandinavia. A new dynasty, the Asir, supplanted it, and established themselves under their leader, who was called in Germany *Wodan*, the same as Odin. He soon became the object of the most profound worship, and to him only were human sacrifices offered. He was regarded as the god of heaven, and the oak was sacred to him. *Thor* and *Frigga* appear also to have been worshipped as divine beings; and if we credit what the Romans said, they must have had besides these a number of other gods and goddesses. But all that has been handed down to us on this subject is too obscure and of too doubtful a character to be accepted as matter of reliable information. The most authentic tradition is that which contains an account of the goddess *Nirthus* or *Hertha* (*pl.* 12, *fig.* 14). She was worshipped as the personification of the earth, the creator and preserver of all animate and inanimate beings of

this globe, and as the ruler of man's affairs. Her chariot was kept covered with tapestry in a sacred grove upon an island in the seas (probably the isle of Rugen) in the centre of which was a calm lake. At different periods she visited the earth, when the priests, who alone were aware of her descent and who were the only persons privileged to approach her, prepared her chariot drawn by white cows, and led her in procession through the country. Everywhere the train was greeted with joyful demonstrations, and the event celebrated as a great festival. Her presence was the harbinger of peace; hostile weapons were laid aside and contending parties united like brothers to hail her arrival. After she had thus visited every part of the country and had restored peace and quiet to every hamlet, she returned to the sacred grove where a hundred slaves were selected to assist in bathing her in the sacred lake. But death was the price which these poor beings had to pay for the privilege of attending upon the goddess; for immediately after she had taken her bath they were drowned in the silent waters of the lake.

Fig. 17 is a drawing of an Alemanic idol lately discovered, but of which little is known.

The priesthood among the Germans was not confined to a particular caste, and the reverence and privileges accorded to priests were granted to the office and not to the individual. Every head of a family was the priest of his household, and one of the oldest nobles filled the office for the district. Great privileges and rights were enjoyed by the priests during the session of the public assemblies, which was always held on the new or full moon, and opened by one of the order. Though without a direct or controlling influence in the deliberations of the people, they had, nevertheless, a great political power, for to them was confided the interpretation of the divination by the casting of lots.

Disputes which could not be decided by human judges were left for decision to what was called the judgment of God, which was either a trial by fire, single combat, or, in particular cases, the casting of lots.

White horses were also kept in the sacred groves, and supported at the expense of the community. They were never permitted to do any ordinary work, but on solemn festive occasions were harnessed to a sacred chariot and driven about, accompanied by the priests and nobles; great attention was paid to their snorting and neighing, from which the priests predicted the course of future events.

The Germans had also their priestesses, but they were not intrusted with the sacrificial service, for their duty was exclusively that of consulting and interpreting the oracles, an office to which a kind of sacred character was attached. Their influence was particularly great in times of war or popular excitement.

At a later period there was another class of sacred virgins who were called *Alrunes*, and were esteemed as infallible prophetesses. No one attempted to dispute their words or commands. They lived always in the solitude of the sacred groves, in which the dwelling stood inclosed by a hedge, and were never intruded upon by any one.

3. The Slavono-Vendic Mythology.

The religion of the Slavonians and Vendes was intimately connected with the mythology and worship of the Germanic nations. It was not, however, so indigenous as the latter, but owed its form and peculiarities more to foreign elements adopted by the nation. This will be readily accounted for when we examine the locality and occupation of these tribes.

The centre of the Slavono-Vendic idolatry was on the Isle of Rugen and along the coast of the Baltic, from Stettin to Rostock. The inhabitants of this region, favored by the natural facilities of their country, at an early day became the traders for all the region along the Baltic. In their mercantile intercourse they acquired not only riches but also borrowed the doctrines and religious belief from many a nation which they visited. But in proportion as they became wealthy, they began to despise the simplicity of their neighbors, and spent immense sums in the erection and ornamenting of costly temples and splendid idols, with which they filled their beautiful towns. Vineta is said to have been the place where Vendic idolatry was first known to flourish. This town is supposed to have been situated near the shore of the Baltic, and was the chief mart for all the northern nations, whose peculiarities of worship were equally tolerated there. When the city was destroyed by war and inundation, the inhabitants fled and built Julin not far from it, which they soon made to rival their lost Vineta in splendor and wealth. Arcona, on the Isle of Rugen, was next founded by them, and finally Rhetra, which, like Venice, was built upon a number of small islands. The latter soon became the city of the gods and the pantheon of all the nations near the shores of the Baltic: Scandinavians, Finns, and Slavonians. Hence the multitude of gods of different nations, German, Finnish, Prussian, and even Grecian, found in the Slavono-Vendic mythology, and the consequent confusion and contradictions in the system.

Some suppose that these strange gods were only admitted by the priests into their secret systems, while the people continued to worship exclusively the gods of their own country. If this is true, then should we have to distinguish between the doctrines of the priesthood and a popular creed. But the whole is involved in so much obscurity that it is difficult to decide with any certainty. We can therefore only give what has come down to us with some degree of reliable authority.

It appears that the foundation of this creed was a belief in one Supreme God, the Creator of all things, and the existence of a host of inferior gods who were merely the servants of their creator. The latter had their sphere of action in the visible world, where they appeared as the representatives of the Supreme Ruler, with power to direct the affairs of man. They themselves were divided into different classes, according to their respective influence, power, and rank. All the gods were supposed to be either white or black, and were according to their color ranked in one of the two grand divisions. The white gods were good and kindly disposed to man, and the black ones bad or evil-disposed to the human race. The Vendes divided them

into *Razi* (counsellors) and *Zirnitra* (wizards). The Supreme Being was supposed to rule over both divisions and partake of the characteristics which distinguished each; but his influence on the visible world he only exercised through their instrumentality.

We have said that *all* the gods belonged either to the white or black division, but there were a few who were exceptions to this rule, particularly among the highest ranks; they seemed, like their creator, to possess the traits of both classes, and were therefore thought to belong to both. Each division had its presiding deity, after whom his followers were called. *Svantevit* was the chief of the gods of light. He is generally represented, as on *pl.* 12, *fig.* 9, with four heads, his right hand resting upon his hip, and his left supporting a cornucopia, which he presses to his breast. He was probably a personification of the Supreme Being, Creator, and Ruler of the universe, who with his four heads watches over the four quarters of the world, and holds in his hand the horn of plenty and consolation; for through it he is said to have absorbed the sun; and when that great luminary shall have ceased to exist, he will console and nourish with heavenly ambrosia the souls who shall be deemed worthy to be fed from the horn of life preserved by him. All souls emanate from him, and to him they return by a gradual ascent.

Next in rank to Svantevit is the god *Radegast*, which means counsellor, and subordinate to the Supreme Being. He is said to have been the first of the gods who became incarnate, and the source of all procreation and birth. His color, which is black and white, designates him as both counsellor and wizard. Among the Vendes he was the god of the sun and probably also of war. An older statue (*pl.* 13, *fig.* 9) represents him with a swan upon his head, a human face in front and that of a lion on the back of his head; upon his breast is a bull's head with a human face. Another and a later statue (*pl.* 12, *fig.* 10) represents him perfectly naked, a bird with outstretched wings upon his head, a shield with the bull's head before his breast, and a kind of halbert in his left hand.

Radegast had two characters, *Shvaixtix* and *Perkunust*, in each of which he was worshipped as a distinct individuality. The former (*fig.* 13) is the sun shedding his blessings abroad, a god conferring benefits upon the human race. Upon his altar the fire was never suffered to go out. As *Perkunust* he is a god of light, both good and bad, or the god of thunder. In *pl.* 13, *fig.* 12 *a*, he is represented with a human face, the head surrounded by ten beams of light, and holding the plough in front of him as protector of agriculture; *fig.* 12 *b* shows the reverse of the statue with a lion's face. Both of these gods were borrowed of the Prussians and eastern Slavonians, for the ancient war and sun god of the Vendes was *Prove*, who is represented with shield and lance (*pl.* 12, *fig.* 11); and their passive deity *Podaga* (*pl.* 13, *fig.* 11) presided over agriculture, fisheries, and the interest of the herdsman, and to him they prayed for favorable weather. But when the new gods were introduced his altar was only sought to obtain propitious weather. They left him, however, his attributes, the boar's face on the back of the head, the plough, the ten beams, and the cornucopia.

The latter reminds us of the god of spring, who in the signs of the ram and bull pours plenty over the land. *Siebog* is reported to have been the god of love (*pl.* 12, *fig.* 12); the back of his head was represented as the head of a cat. *Sieba* (*pl.* 13, *fig.* 10) was the goddess of love. *Nemisa* was feared and worshipped as the divinity who cut the thread of life. Sometimes we find this idol in the shape of a man (*fig.* 13) with four beams around the head and one wing, on the front part of the body a dove with outstretched wings; at other times it is represented in the shape of a naked woman, with an eagle by her side looking up to her. Nemisa was considered as belonging to the black gods, inasmuch as death was regarded as a calamity; but on account of the beneficial office which he performed by introducing the soul through death to a new life, he was also honored as a white or a good god. *Triglav* (*pl.* 12, *fig.* 8) was a very important deity among the Vendes, and his statue at Stettin which represented him with three heads, was explained by the priests to be symbolical of his dominion over heaven, earth, and the lower regions. Sometimes he is found with a veil covering his head, emblematic of his willingness to hide his face from the sins of men, and to pardon them. Some supposed that it was an emblematical figure of the Trinity veiled from the sight of mortal eyes. The moon too was represented by a deity called *Ziselbog* (*pl.* 11, *fig.* 12), but it was a very uncouth form, though not more so than that of *Ipabog* (*fig.* 13), the god of the chase, whose head was decorated with two beams and a pair of horns, and upon his back were engraved the symbols of hunting.

The chief among the black or evil gods was *Pya*, generally called *Zernebog*. He was the god of bloody deeds, and as such was represented as a fierce lion, erect, with his head somewhat elevated, though sometimes the head alone served to denote the god. The black gods, who did not share any of the qualities of the white ones, were usually represented as animals.

Next in rank to Pya was *Flyntz*, the god of death, among the Zirnitra. He was generally represented in the shape of a skeleton with a lion upon its shoulder, a burning torch in its hand, and its feet placed upon a large pebble. Sometimes, however, an old man (*pl.* 12, *fig.* 15) with all the attributes of the skeleton, only a flint instead of a pebble is beneath his foot as an emblem of the resurrection. In this form he was therefore numbered among the gods of light.

Hela, the goddess of the lower world in the Germanic Mythology, was also included among the Zirnitra, and was represented by a lion's head with an outstretched tongue. *Myda*, another of the dark gods, appeared in the shape of a crouching dog. Besides these they had numerous forest and house gods to whom only a local worship was paid. A number of statues of idols have been found, of which neither the name nor the office is known. We have represented two of these belonging to the Slavonic Mythology on *pl.* 11, *figs.* 14 and 15; on *pl.* 13, *fig.* 14 *a* is a Sarmatian, and *fig.* 14 *b* a Silesian idol, though it is possible that the latter may, like *pl.* 11, *fig.* 10, be intended to represent *Thor* in the shape of *Tyr*. *Pl.* 13, *figs.* 15 and 16, represent idols of which neither the nature nor the place of worship is known.

Numerous and frequently costly temples were built for the worship of many of the above-mentioned gods. The chief temple was the one at Arcona. It was a wooden structure in an open place near the centre of the town, and was divided by a partition which ran through the whole building. The exterior of the walls was richly carved, and they were supported on the inside by four pillars; cloth tapestry served instead of walls to divide the whole into separate apartments. Here was kept the gigantic statue of the four-headed Svantevit, with the hair and beard cut short, according to the custom of the Vendes. Close by it are always found his immense saddle and bridle, and the two-edged sword, the grip and scabbard of which were of chased silver.

The worship in this temple consisted in feeding and tending the white war-horse of the god, which office had always to be performed by the high priest, whose duty it was also to ride him out for exercise, though it would appear that he must have had enough without this; for it was said that the god mounted him every night, and rode forth to battle against the enemies of his religion; this was assigned as the reason why the horse was found every morning covered with perspiration. Peace and war depended also upon the actions of this horse; for he was always consulted before any warlike expedition was undertaken. This was done by laying a number of spears upon the ground, a short distance one from the other; the priest then led the horse across them, and it being considered a favorable omen if he passed three times over them without touching any one, war was then determined upon; but if he touched one with his foot it was considered an unlucky sign, and the contemplated expedition was abandoned.

In this building they kept also the sacred banners, and the ample treasures of the temple, consisting of precious metals, silks, and other stuffs. The revenues of the temple were very great, and were collected from the spoils of war, a third of which was deposited with the priests for its support; besides this, every citizen had to pay an annual capitation tax into its treasury. The conquered nations were also made to contribute to its support, and foreign merchants and princes enriched it with many presents. Independent of all this, it drew a large income from a band of 300 horsemen, called the Sacred Host, who were exclusively in the service of the priesthood, and who had to deposit in the hands of the priests whatever gain or booty they became possessed of.

There was another temple at Rhetra also built of wood, and with carved walls; its foundation consisted of bulls' horns, collected from sacrificed animals. This temple also was the depository of sacred banners. Its annual revenues were collected not only in money, but also in animals for the altar. Almost all the idols found here were frightful figures, covered with cuirasses and helmets; for the priests, whose revenues were materially increased by every expedition against other nations, were themselves of a warlike disposition; and since the interpretation of the oracle of lots, which was consulted in all cases when an irruption was contemplated, was in their hands, they took care to consult their own interest.

Similar to this temple was the one at Stettin, consecrated to *Triglav.*

On the outside it was covered with well executed carved figures, representing men, beasts, and birds, to which remarkably good and permanent colors imparted a life-like appearance. The interior was filled with the trophies of war, treasure, and arms, for a tythe of all the booty captured upon the water or during an expedition on land had to be deposited here, hence there was a great quantity of golden and silver cups used in soothsaying, and numerous vessels of all kinds used at the banquets of the great.

The priests of the Slavono-Vendic nations were highly cultivated, and possessed a great knowledge of the world and mankind. From the Germans they had learned to write, and from the Scandinavians the use of the runes. They were, moreover, in constant communication with the priests of other nations, and procured from their Greek friends their most beautiful cast metal idols. Among themselves they had established a perfect hierarchy, and all were divided into classes, the lines of which were drawn with great precision. The chief, or high priest, lived always at Arcona, and the priests of a number of districts were under his control. Even the secular authorities were subordinate to the spiritual power. The ceremonies of the daily worship and the service in the temples of the inferior gods were conducted by the priests of the lower ranks, but the service of the superior gods could be performed only by the high priests.

All or at least most of the Slavono-Vendic nations observed Monday as a sacred day. The most important festival was the annual harvest-home celebrated at Arcona. The high priest (*Krive*) prepared for its celebration by sweeping with his own hands the temple of Svantevit, and then killed the sacrificial animals before the gate. Afterwards he took the cornucopia from Svantevit and examined its contents. If he found that the mead poured into it during the previous festival had diminished in quantity, he predicted a scarce harvest, and exhorted the people to husband their resources. If on the contrary he found the horn still full, he announced a season of abundance, and then poured out the old mead at the feet of the idol. Having prayed for a blessing upon the people, he emptied quickly the horn now filled with new mead, and then returned it, after it had been filled for a second time, to the hand of the idol. The ceremonies concluded by his going behind a huge cake made of flour and honey and spices, nearly as high as a man, and asking the people whether they could still see him. As soon as they had answered in the affirmative, he prayed that the abundance of the next year might be such that they would no longer be able to see him behind it. Then turning to the assembly, he exhorted them to be pious and good, and dismissed them with a blessing.

The rest of the day was spent in eating, drinking, and carousing, for it was considered a sinful thing to retire sober from the banquet.

Human sacrifices were not uncommon, and Christians were preferred, because they were hated for their zeal in making converts. The blood of the victims was afterwards used in soothsaying. The Rugians, one of the most savage tribes, are said to have been particularly cruel when slaying their Christian victims.

VI. THE MYTHOLOGY OF THE GAULS.

More obscure even than the mythology of the Germans is that of the Gauls; partly because their early history is very little known, in part because their religion in the course of time has undergone a number of changes owing to foreign influence. The Celts, to whom the Gauls belonged, were known among the nations long before the Germans had any historical existence. They were already possessed of a considerable degree of cultivation, and had even commenced to decline when the latter made their appearance as active participants in the affairs of nations. Subdued by the Germans and the Romans, all traces of their mythology were lost, except such portions as were transmitted to us by the Romans in their accounts of the worship and religious ceremonies of the Gauls, who had also adopted much of the religion of their conquerors.

From the sources just mentioned we learn that a few gods only were universally worshipped by the whole nation, the greater number were merely local gods whose worship was confined to particular districts; they paid also divine honors to a kind of inferior spirits subordinate to the regular gods. Tacitus informs us that *Mercury* was their chief god. But his form (*pl.* 13, *fig.* 20), so very different from that of the Roman god, as well as some of his offices, would lead us to suppose that the name given him by the Roman historian was probably not the proper one. He was represented in a great variety of shapes, sometimes even with breasts like those of a woman. The popular creed considered him as the inventor of all arts, the guide of travellers, and the god of merchants and particularly traders. One of his statues, evidently modelled after the Roman type (the one to the right in *fig.* 23), represents him with a winged helmet upon his head, in his right hand a money bag, in his left the caduceus (a staff around which two serpents are entwined, and which served him as a herald's staff and also as a wizard's wand to induce sleep, to make himself invisible, or to transform himself), and upon his shoulders sits the cock, a symbol of watchfulness and active courage.

Next to Mercury in power was *Nehalennia* (*pl.* 11, *fig.* 16), a goddess of Belgium. She is sometimes represented standing, but more frequently in a sitting posture, and holding a basket filled with fruit in her lap. Her hair is thick and parted over the forehead; over her ample dress she wears a cloak without sleeves, and the collar around her neck is fastened over her breast by a button. At her left is a dog watching the contents of the basket, and on her right is a larger basket made of wicker-work and supplied with a handle. She was the goddess of commerce and navigation.

Magusanus (*pl.* 12, *fig.* 16) was another of the Belgian idols. He is often represented by the side of Nehalennia, upon votive tablets. Under his right arm he holds a dolphin, and in his left hand a forked club A scaly little monster of the deep seems to bite the little toe of his left foot. These attributes make him certainly appear as nearer allied to the water gods than to the Roman Hercules.

Pl. 13, *fig.* 21, is supposed to be a representation of *Hercules Saxanus*, of whose office or character thus far nothing satisfactory has been discovered.

The other gods known to us as worshipped by the Gauls were evidently introduced by the Romans.

The first is *Jupiter* (*fig.* 17), who was worshipped in Gallia as *Taran* or *Taranis*. Nothing is known of him with certainty, except that human beings were sacrificed at his altars, and that the lofty oaks were considered as his emblems. Roman authorities inform us that he was considered as the lord of heaven. *Fig.* 18 is another representation of this god somewhat different from the previous one. Here he is seen but partially clothed with a cloak, holding in his left hand a lance, and accompanied by the eagle, who was sacred to him.

Next to Jupiter, *Apollo* was worshipped by the Gauls, under the names of *Belin*, *Belen*, and *Abelio* (*fig.* 23, the first left hand figure). He appears to have been a particular object of worship to the sick at watering-places, and he had a temple near a warm spring, which was dedicated to him as the giver of recovery. Apollo had also his oracles in Gallia, which were consulted chiefly in cases of sickness. The henbane, called after him *Velinuntia* and *Apollinaris*, was sacred to him. The Gauls dipped their arrows in the juice to make the wounds of the deer more surely mortal. As late as the 11th century we meet with a superstitious custom connected with this herb. When the country suffered from a prolonged drought, the women and young girls were wont to assemble together and elect the youngest and most innocent among them for their queen. She had to undress and proceed in a state of perfect nudity at the head of all her subjects, to a field to seek for henbane. When a plant had been found, she had to dig it out by the root with the little finger of her left hand, and then fasten it to the little toe of her right foot. Each of the rest then armed herself with a branch of the plant, and the procession directed its course to some rivulet, the queen carefully dragging the henbane after her. When arrived at the water she was immersed, and the rest sprinkled her also with their branches moistened from the rivulet. They then returned to the place from which they had started, the young queen being compelled to retrace her steps backwards.

In many districts *Vulcan* was also another object of worship, as the god of fire, and the inventor and protector of the arts which were carried on by the aid of fire. In *pl.* 13, *fig.* 19, he is represented as standing with a hammer in his right hand and a pair of tongs in his left. *Fig.* 23 shows him seated between four other figures; the same symbols of his profession are in his hands.

The goddesses of Gaul were chiefly *Venus Anadyomene* (*pl.* 12, *fig.* 19), she who had ascended out of the sea; she was the goddess of love; *Isis* (*fig.* 20) and *Diana* (*pl.* 13, *fig.* 22), as *Matres Augustæ*. In this capacity the latter was the symbol of nature, the all-supporting mother, who manifests herself in all creatures. She was represented as a three-fold female figure, with her backs leaning against a pillar and in her hands the cornu-

copia, fruits, &c. *Ceres* and *Minerva* are also found here (*fig.* 23, near Vulcan), but their statues were different from those by which the Romans represented them. The former, who was the goddess of agriculture and the framer of laws, is dressed in a spotted garment, a kind of helmet on her head, and a cornucopia filled with fruit in her hand; the latter wears a similar garment but without sleeves, and has the breast protected by a cuirass; upon her head is the helmet and by her side the shield; the owl, sacred to her, sits perched upon her shoulder; she thus resembles somewhat *Bellona*, the Roman goddess of war.

The priesthood and the nobility were the only orders among the Gauls that had power and influence, for the people were at an early date already reduced to a state approaching slavery; they were never suffered to have a will independent of their rulers, nor a share in the political deliberations. The priests, who were called *Druids* (*pl.* 13, *fig.* 24), had established a strictly theocratic-monarchical constitution, and held the first rank in the state. They were governed by a high priest, who represented the highest spiritual and political power, and was always elected for life. If there happened to be two eligible candidates, they settled the difficulty by lot or single combat; for they were warriors as well as priests, and always led their armies into the field, and when they ceased to do so they found that their power also began to decline. They were also the highest judicial tribunal, and decided in all civil and criminal cases, whether they referred to inheritances, boundary lines, or murder. They enforced their decisions by excommunicating the refractory, which was the heaviest penalty that could be inflicted, for it excluded the person from the privilege of assisting at the sacrifices. He who was thus punished was shunned as a wicked and accursed being, every one avoided him for fear of being contaminated and having to share his lot. This excommunication was probably pronounced publicly during the time of the annual assembly which was held near the city of Dreux in a sacred grove, and where all judicial disputes were settled.

The Druids lived together as a community somewhat in a monastic style, for they had everything in common. Many coveted the privilege to be admitted into their ranks, and even the nobles sought it eagerly, for it offered great inducements; but they required a rigid noviciate, which lasted sometimes twenty years. Their instructions to their disciples were altogether oral, and conveyed sometimes in verse, which the candidate had to learn by heart. They also enjoined upon all strict secresy, and particularly that no part of their lessons should ever be made known to the people. This leads us justly to suppose that they also must have contained mysteries.

Besides the priests there were priestesses or *Druidesses* (*fig.* 25). But it is not known what their relative duties were, and to what they were limited.

The *Bards* and *Vates* are said to have constituted a separate class among the priests. The former seem to have been the sacred minstrels, and the latter the prophets or soothsayers. But there must also have been a class

of secular Bards, for we find that persons with that title were the constant attendants of kings and nobles, whom they accompanied even in war in the capacity of minstrels.

An important part of the worship of the Gauls consisted in sacrificing to the gods, and not only animals but often human victims bled upon their altars. Some of these sacrifices were of a public and others of a private character, for some were offered by the state, while others were brought by families or private individuals. When any one was dangerously sick or engaged in war, or otherwise exposed to imminent danger, it was customary to vow or sacrifice a human life, for by such means only it was thought that the gods could be appeased and satisfied; it was as if a life was given for the life granted. The victims offered by the state were generally thieves, murderers, and other criminals, though in the absence of such they had no scruples in slaying innocent persons. Some Gallic tribes were in the habit of preparing for such an occasion a colossal figure of wicker-work, which they filled with human beings, and then destroyed the whole by burning the figure. The victims selected by families and individuals were generally slaves and clients or dependents. Besides the sacrifices of thanksgiving or atonement, they had also their funeral sacrifices, when all that the departed valued most, even his animals and favorite slaves and dependents, were burned with him upon the funeral pile.

Under the head of public sacrifices ought also to be mentioned the savage custom which condemned all prisoners who had been confined for more than five years to be hung upon posts and to be burnt on a pyre with other offerings, and the law which condemned prisoners of war and animals taken during an incursion to be killed by the sword or by fire.

We have already said that it was the business of the Druids to predict future events from the flight of birds and the entrails of the victims; the latter were therefore also frequently selected for this purpose, but instead of disembowelling them, they were slain by a different process. If an important subject seemed to require a divination, they selected a victim who was killed by a stab through the heart, and then suffered to fall down; from the manner of his fall, his last agonies, and the blood as it flowed, they then determined the probable result of the matter in question.

The altars were generally erected in sacred groves, particularly beneath oak trees, for the oak was esteemed above all other trees. The priests never officiated without chaplets of oak leaves upon their heads, and oak groves were always selected for their residences and tribunals.

All parts of the oak, as well as its parasites, were therefore considered as favorite gifts bestowed by the gods upon man, as a mark of their approval and favor. Distinguished above the rest was the mistletoe; and the 4th of January, the day on which it was searched for, was celebrated as a high festival. *Pl.* 13, *fig.* 26, represents a part of the ceremonies attending the search. The priest has just discovered the sacred parasite, and is in the act of severing it from the tree, surrounded by a breathless audience, eager to possess themselves of a part of it. A great importance was attached to this annual search for and distribution of the mistletoe. The Druids

announced the coming of the period by a general proclamation, when all the people collected in the woods between Chartres and Dreux.

The ceremonies commenced with a solemn procession, headed by a choir of bards, whose chief business it was to sing hymns during the sacrifices; then came those who had to slay the victims, and the soothsayers. At a little distance followed two white oxen, the victims for the day. A herald marched behind them, dressed in a white garment, with a winged helmet upon his head, and holding in his hand a branch of verbena, around which two serpents twined, giving it the appearance of a caduceus; to him were confided the novices or those young men who were prepared for initiation, and who walked behind their guide. Then came the three oldest Druids, one carrying the bread about to be offered on the altar, another a vessel filled with water, and the third an ivory hand fastened to a staff, the symbol of justice. The high priest, with the rest of the Druids, closed the procession, and the nobles and people brought up the rear. When they had arrived at the foot of the oak upon which the mistletoe grew they halted, and the high priest made a short prayer, burned the bread, and then poured the water upon the fire. The morsels of the bread and portions of the water left in the jar were then divided among the bystanders After that, the high priest ascended the tree and severed the misletoe from it with a knife shaped like a sickle, and threw it down on the outspread garment of one of the Druids, who for a short time held the sacred plant aloft so that all could see it, and then deposited it upon the altar, where every one was permitted to examine the precious boon. After the high priest had descended from the tree he again made a short prayer, and terminated the ceremonies of the search by sacrificing the two white oxen. The mistletoe was then handed to the Druids of lower rank, who in the course of the day distributed small pieces of it among the people as a new-year's gift. It is difficult to determine what may have been the meaning of this ceremony, or its allusion. It has been the subject of much inquiry and a great deal of research, but nothing definite has as yet been ascertained.

A late French mythologian thinks that he has discovered a solution in the myth of the death of *Baldur*, mentioned in the Scandinavian mythology. He says: "The religion of the Druids was not confined to the Gauls, it was also introduced among the Germans, Britons, and Scandinavians, and after it had been already extinguished in Gaul, Germany, and Britain, it was still preserved in the north as late as the twelfth century. During this period they collected in the Edda all the dogmas, customs, and rules, previously only transmitted by oral lessons. Now, the myth of Baldur's death, found in the Edda, offers a solution to this problem. For the search after the mistletoe and its subsequent destruction are intended to deprive the god of darkness (*Loke*) of the means to kill the god of light (the sun). And the distribution of small pieces of the mistletoe was to provide pious souls with amulets to protect them against the wicked temptations of Loke."

Others say that the mistletoe was considered a medicinal plant of great virtue, and a decoction was made of it, which was a powerful antidote against poison, and imparted fecundity to every living being.

At a later period, particularly after the religion of the Druids had ceased to exist in Gaul, we find that the mistletoe was also introduced into the religious systems of various Germanic nations (*pl.* 12, *fig.* 18), and it sustained itself until banished by Christianity, with the rest of the system to which it belonged.

VII. THE MYTHOLOGY OF THE MEXICANS.

The Mexican system of mythology was probably a fusion of the religion of the primitive inhabitants, with the doctrines introduced by immigrant nations, particularly the Azteks. The latter came in the year 1160 from the north, and traversing different countries, finally settled within the territory of Mexico, of which they became after some time the rulers. It followed as a matter of course that the religion of the conquerors was soon engrafted upon and partially supplanted that of the conquered. We know therefore nothing of the creed of the primitive inhabitants of Mexico except what can be gleaned from their mythology, as it was taught under the administration of the Azteks.

The great doctrine of this system was that there is one supreme invisible being, lord and creator of all. This supreme intelligence was never worshipped, for he was deemed too holy and lofty to be addressed by mortal men. He was never represented by images, but was called *Teotl* (god), *Ipalnemoani* (he by whom we live), and *Tloque Nahuaque* (he who has all in himself). To him no temples were ever erected as to the lower gods, who were considered emanations from him.

The gods which the Mexicans worshipped were divided into two ranks, the higher and the lower, but all were considered the servants of the supreme being.

The chief of the thirteen higher gods was *Tezcatlipoca*, the soul of the universe, the creator of the visible world, who rewards the good and punishes the bad.

Next to him in importance was *Huitzilopoctly* or *Vitziliputzli*, who was the chief god of war, and patron god of the Mexicans. Two of his brothers, also gods of war, were subject to his commands.

Every element had also its presiding deity. Thus we find a god of the air, who inhabited lofty mountains, where the spirits of the air and the hills executed his orders; a god and goddess of water, who dwelt near the highest springs, surrounded by serving water spirits; a god of fire, to whom at table the first morsel and the first draught were offered, by throwing them into the fire; and finally a goddess of the earth. This prolific system acknowledged gods for everything, arts, sciences, natural productions, and passions.

The Mexicans believed also in the existence of spirits inferior to the gods, but with great power to do good or harm. The bad spirits were represented by ugly, uncouth figures, and the house gods by pretty little statues. The

number of these little gods kept in a house was prescribed by the rank of the family; for kings, princes and the great nobility were permitted to have six, the inferior nobles four, and others only two.

Tetevinan was the mother of the gods. She was the daughter of the tyrant *Colhuacan*, upon whom the Mexicans wished to avenge themselves. They therefore demanded his daughter, under the pretence that their patron god required that she should be dedicated to him as his mother. The king dared not refuse, and the girl was received with great solemnities and sacrificed to the god, and has ever since been worshipped as the mother of the gods. The sun and the moon, of whose curious history we shall presently speak, were also worshipped as deified heroes.

The Aztek or Mexican cosmogony is very remarkable. They believed that time was divided into four ages or periods. The first of these they said was *Atonatiuh*, the age of water, which terminated with a universal deluge, by which all created things, even the sun and the moon, were destroyed. Only two human beings were saved in a boat made of a hollow tree, and landed finally on the mountain *Colhuacan*. These became afterwards the founders of a new race, which lived during the second age. This period was called *Tlaltonatiuh*, the age of the earth, and terminated with a terrible earthquake, after the new creation had existed 5206 years. The third period, *Ehecatonatiuh*, the age of air, was closed, and the world again destroyed by *Quetzalcohuatl*, the god of the winds, who came down upon the earth armed with a sickle, and swept the nations from the earth by the power of his breath. The fourth period, *Tletonatiuh*, the age of fire, now commenced, everything having again been created anew, except the sun and the moon.

The divine heroes (the great giants) assembled around a fire in *Teotihuacan*, and told the people who accompanied them that the first person who would throw himself into the flames would rise as a new sun in the firmament. Then arose *Manahuatzin*, the most courageous among them, and leaped into the burning mass; his soul soon reached the lower regions and presently appeared in the east as a new sun.

A new moon was now only wanting, and this was supplied by *Tezcociztekal's* self-immolation, who followed Manahuatzin's example and appeared again as the pale luminary of night.

This is the period in which we live, and which will last 5206 years, and then terminate with a universal conflagration.

The Mexicans believed in the immortality of the soul, and distinguished three places of abode for the immortal spirits after their separation from the body. Those of the nobles and the soldiers who died in battle or in captivity when taken with arms in their hands, and those of women who died in labor, were supposed to be conducted by *Teoyaniqui* to the house of the sun, where they led a life of endless delight amidst eternal festivities and singing and dancing. At different periods they received permission to visit the earth, and to animate clouds and birds of beautiful plumage, as well as lions and jaguars, but were always at liberty to rise again to heaven.

The souls of those struck by lightning, of those who died by disease or

were drowned, went, with the children sacrificed to *Tlaloc*, to a place called *Tlalocan*, the paradise of this god. This was a cool and shady place, where they had the most delicious repasts and every other kind of pleasure. Lastly, those who suffered any other kind of death went to *Mictlantocli*, the kingdom of *Mictlan*, the god of hell, which was a dark and gloomy place in the centre of the earth.

Such of the idols as still exist, most of which were only lately discovered, are particularly distinguished by the accumulation of the greatest variety of figures and devices with which they are ornamented. In a great many instances it is even difficult to determine whether they were idols; and if so, what particular deity they were intended to represent. On *pl.* 14, *figs.* 1 and 2, we have represented two of these strange-looking objects of worship among the ancient Mexicans; *fig.* 3 is an old bas-relief on a sacrificial stone, representing an Aztek idol; *figs.* 4 *a b*–7 were probably idols of the Guatemalians, and were found among the ruins of Tlapellan and Palenque; the first of these seems to represent a deity worshipped by two human beings, or lower spirits. *Figs.* 14–16 are colossal heads, and therefore in all probability parts of some similar idols. *Figs.* 17–19 belong also to this class; the last of the three was found near Copan, beneath the ruins of an Indian city, destroyed by the Spaniards in 1530, and only lately rediscovered. *Fig.* 20 represents an altar upon which a similar idol stands, and *figs.* 25–28 are drawings of figures made of burnt clay, and supposed to have been idols of Yucatan. On the same plate we give also a few other articles connected with the worship of the Mexicans, *e. g. fig.* 12, a circular top of a Mexican altar; *figs.* 21–24, basins and bowls used during the sacrificial service, supposed to belong to Guatemala; and *fig.* 29, a vase of burnt clay from Yucatan.

The materials of which the idols were made was either burnt clay, wood, stone, or the baser metals, and some statues were even of solid gold; but the grotesque combination of forms of which they were composed made them always look ugly.

They were kept in private houses as well as in the temples, and worshipped with prayers offered up in a kneeling posture, and with the face turned towards the east.

Vows were made to them, festivals celebrated to honor them, penances suffered to appease them, and fumigations and victims offered at their altars.

The greatest and most numerous public sacrifices of human beings were those offered upon the top of Mexitli's temple (*pl.* 14, *fig.* 13).

When the day for the sacrifice had come, the priests dressed themselves in their white garments bordered with long fringes, and fastened their hair with leather straps; but the high priest wore a red cloak, and upon his head a coronet of green and yellow feathers; in his ears were golden rings set with emeralds and turquoises, and from his under lip hung also a large turquoise. The victim selected for that day was then adorned like the god to whom he was about to be sacrificed, and was forced by his executioners to attend all the amusements which preceded the sacrifice, as a kind of

introduction to it. At last, when the hour of his execution drew nigh, he was brought to the temple with a numerous guard around him, to prevent every attempt to escape. On the threshold a priest awaited his arrival, with an ugly little idol in his arms, made of corn meal and honey, the eyes being green stones, and the teeth kernels of corn. As soon as the prisoner approached, the priest descended hastily, and seating himself upon a little platform, held his little monster towards the victim, and exclaimed: "Behold! your god." The prisoner was then undressed and his bonds removed, and in the company of six priests conducted to the roof of the temple, where they kept the sacrificial stone. This was a slab of green jasper, five feet long, and a little raised in the centre. Upon it he was stretched out, while four of the priests held his hands and feet, and a fifth threw around his neck a wooden collar made in the shape of a coiled serpent, by which he kept his head upon the stone.

The high priest (*Tolpetzin*) then came forward, and held aloft the idol to which the prisoner was about to be sacrificed, while he called upon the spectators to worship it. This having been done, he approached the altar, armed with the terrible sacrificial stone-knife, and made a deep incision in the breast of his victim, from which he tore the bleeding and still palpitating heart. At first he held it up towards the sun, and then threw it at the feet of the idol, where he left it only for a second or two, when he picked it up again, and either put it in the mouth of the statue or rubbed its lips with it. After this it was burnt, and the ashes scattered in the air.

If the victim was a prisoner of war, they cut off his head, and then threw the body down among the people, where the officer or soldier who had captured him stood ready to receive it, and to feast his friends upon the horrid dishes prepared of the flesh. The head was then placed by the priests in a building set aside as a receptacle for the heads of all victims slain at this altar. The largest building of the kind was called *Huitzomban*, and was a huge truncated pyramid of earth, on whose top were seventy large trees, with bars passing from one to another, upon which the skulls were exposed. These savage sacrifices were very common among the different nations of Anahuac, who had gradually adopted the religion and customs of the powerful Azteks.

But the Azteks, who were more warlike than the other nations, had also a custom peculiar to themselves. During certain festivals, they permitted the bravest or most noble of their prisoners to fight in single combat for their lives. If the prisoner accepted this offer, one of his feet was fastened to a large stone, and he was furnished with sword and shield; he had then to defend himself against the antagonist who had offered to slay him as a sacrifice. But only the same arms were permitted to this champion, and the combat had to take place before the assembled multitude. If the prisoner became the victor he escaped not only a horrid death, but was also honored with the titles and dignities which the laws of the land bestowed upon the most renowned warriors, and was permitted to return to his country laden with arms and booty. But the conquered man had to take his place on the bloody altar, for the priests were unwilling to set a

precedent by which a victim, without offering a substitute, might escape their clutches; and the people, like the Romans at the gladiatorial combats, wished not to be deprived of their more than savage pleasure of gloating over the dying agonies of a fellow being.

Not only individuals but large bodies of men were sometimes slain at the altar at one time, particularly during their so-called great sacrificial festivals; various historians assure us that several times more than 2000 prisoners were sacrificed during a single festival. In most of the temples it was also the custom to fatten every year a prisoner of distinction, so as to be sure of a victim for the time of sacrifice.

The priesthood of the Mexicans was a very powerful order, composed of priests of different ranks and influence. Those of the order whose duty it was to officiate at the bloody altars wore a particular dress and painted their bodies black. The high priests were called *Teoteuctli* (the divine lord) and *Hueiteoquixqui* (great priest); besides these names, they had also the title of *Tolpitzin*. The priests lived together in convents, having a community of goods, and were only subject to the discipline of their order. It appears also that they had priestesses, but not much is known of the duties that were assigned to them. On *pl.* 14, *fig.* 9 *a* and *b*, are two busts supposed to represent a front and back view of a priestess in her sacerdotal dress and ornaments.

The temples (*teocallis*), which were considered the earthly palaces of the gods, were built in the shape of a truncated pyramid, and were found everywhere, in cities, on mountains, in the forests, and on the public highways.

The priests were, as among all rude nations, the only conservators of science. We have copied on *pl.* 14, *fig.* 11, their almanac as described by Alexander von Humboldt. The concentric circles, with their numerous divisions and subdivisions, are drawn with mathematical accuracy. The execution of the whole shows also the taste for a repetition of the same figures, the spirit of order, and appreciation of symmetry, which supplies among all half-civilized nations the sense for the great and good.

They were also acquainted with a species of writing by which they transmitted important events, laws, and customs. It appears, as may be seen from the fragment (*fig.* 8), that it was a hieroglyphic language, and consisted not so much of what is usually understood by writing as of a symbolical representation of the subject which it was intended to communicate.

Their computation and division of time were remarkably peculiar. They divided the year into 18 months, each having 20 days, which were named after the festivals and occupations for which they were set apart. At the end of the last month there occurred always five leap-days, *Nimontimi* (the empty or useless ones), so called because they were only employed in making and receiving visits. Every four years they had also a leap-year; but instead of letting it occur at its regular period, they waited until the fifty-second year, when they intercalated the whole thirteen at once. But in their chronological computations they paid no attention to the months and years into which time was divided, for they made all their calcula-

tions by periods of 13 days and 13 years. They counted thus always up to thirteen and then commenced again a new section of time.

Pl. 14, *fig.* 10, is a drawing of an almanac representing the ancient Mexican year with its divisions. The middle circle, as will be seen, was divided into six sections, each containing three figures; these were the signs for the months.

They commenced their year on the 28th of January, though some authors say their new-year came as late as the 26th of February.

CLASSIC ANTIQUITY.

I. THE RELIGIOUS SYSTEM OF THE GREEKS.

Among no people of antiquity do we find mythological poetry so distinguished for its fulness and variety as among the Greeks. For this fact several causes existed. The great diversity of the tribes, which ultimately blended in a good degree, but which still retained certain national peculiarities; the vast influence of neighboring and even distant tribes, produced by frequent immigrations as well as by the commercial relations in which the Greeks stood to other countries; the astonishing perfection which they had attained in sciences and arts, particularly in painting, architecture, and statuary; the scholars, philosophers, and poets, whose fame reaches even the present time: all these agencies contributed to the evolution and embellishment of the Greek religious system, and make it an object not less worthy of attention than the philosophy and literature of that interesting people.

As with the inhabitants of Greece, so with their mythology numerous alterations naturally took place. No people ever sprang to their highest civilization at once, and the same law of progression holds good with the religion of a nation. The immigrations also to which we have referred often influenced the character of the Greeks, and introduced new elements into their religious observances, so that we find several periods of religious and mythological cultivation. What may have been their precise origin, when and from what source they may have been adopted, and at what period the circle of the gods may have been completed: these are questions which can be determined with but little certainty. It seems most probable that the Pelasgi, the aborigines of Greece, already had gods and a species of worship which, receiving additional elements from Egypt, Phœnicia, Phrygia, Persia, and other countries, gradually adjusted itself to the new principles, and so assimilated all the material constituents as finally to evolve a system sufficiently harmonious in all essential points.

That which principally distinguished the mythology of the Greeks from that of other nations was its multiplicity of gods and deified beings. In addition to the superior deities adopted from abroad, and modified according to the peculiar ideas and wants of the worshippers, they reverenced many others originated by themselves. They recognised gods of the upper

and lower worlds; the powers of physical nature personified, or rather spiritual agencies controlling and directing natural forces; tutelar deities and genii of rivers, trees, mountains, forests, cities, and states. Virtues and vices, qualities, occupations and conditions of life, at first symbolically represented, gradually came to be regarded as independent beings, and received a position among the acknowledged deities. Gratitude not unfrequently contributed to increase the number of deities. Whenever a man had shown himself a benefactor of his countrymen or of his race, or had distinguished himself by any extraordinary transactions, he was certain to be honored by public homage, celebrated in popular songs, or to have his name and the memory of his deeds perpetuated by monuments. As the outlines of his character grew indistinct in the twilight of receding ages, men gradually thought of him as a being of a superhuman grade, the poets ascribed to him divine attributes and performances, his supernatural origin was discussed, admitted, and believed, and the circle of the gods was enriched by a new member. It also happened that every tribe among the Greeks retained in their mythology the gods of their ancestors, and when a new deity was to be adopted into their system they merely created for him a new department and assigned to him new qualities, so that in many instances the same god might have among different people the same name but various spheres of activity.

The Grecian mythology was also essentially distinguished from others by its general spirit and tone. It managed to keep aloof from the hideousness and absurdity of the Indian system, from the filth and bloodiness of the Babylonian and Phœnician, and from the gloomy solemnity of the Egyptian, although all these had furnished portions of the materials out of which it was composed. A spirit of joyousness, liberty, and heroism, as well as a gleam of the beautiful and the sublime, vitalized and graced the whole system, and assisted in concealing or at least diminishing the darker features inseparably connected with its existence. The grounds of this peculiarity are to be sought in several circumstances, among which we reckon, first of all, the serene and favorable climate of Greece, together with the energy and love of liberty of the people. At a very early period the majority of the Greek tribes obtained free political constitutions, under whose healthful operation they realized a high state of culture. It contributed not a little to the same end, that the Grecian mythology had no exclusive caste of priests. It encouraged no bigoted supervision of individual belief; it placed no odious restrictions upon the prevailing religious ideas and feelings. All embarrassment being thus removed, the poets and artists vied with each other in representing religious conceptions in their purest and most ennobling form. Indeed, poetry was regarded as particularly devoted to the service of the gods, so that it freely employed its resources in separating from mythology all extraneous and uncongenial ingredients, and bringing it into organic union with the national modes of thought and action.

Despite their high cultivation, the Greeks failed to comprehend the idea of a pure spiritual essence. Accordingly, they regarded their gods as

similar to men, though of course much their superiors in every respect. While according to them omniscience, omnipotence, sanctity, and a high degree of felicity, they nevertheless associated the idea of these qualities with that of human bodies, human feelings, inclinations, and passions. They even endowed them with organs of sense, and imagined them capable of vice and crime. These apparent contradictions can only be explained by the fact (so often noticed by historians) that the Greeks were at the same time a most intelligent and a most sensual people. The most educated among them, as among other nations, were accustomed to consider much of the popular faith as merely symbolical or really fabulous, whilst they secretly cherished their own opinions; and this was the cause from which sprang the well known mysteries. Whatever the philosophers and the educated may have really thought concerning the truthfulness of their religion and the appropriateness of its rites and ceremonies, yet, finding them of importance in the preservation and improvement of civil society, they rendered them a hearty public support.

Cosmogonies and Theogonies, or the Origin of the World and of the Gods.

In no part of Grecian mythology do we encounter so much variation, obscurity, and contradiction as in the legends concerning the creation of the universe. Closely connected with this inquiry and not less puzzling are the fictions relating to the origin and genealogy of the gods. No one of the Cosmogonies and Theogonies has ever obtained universal credit, and perhaps no one can be said to possess superior claims upon general confidence. We give a condensed account of the three theories which have existed the longest, and have received the widest acceptation.

According to the first, *Water* was the primordial germ of all things. The water engendered from itself *Slime.* The combined energies of the water and the slime produced a *Serpent* or *Dragon* with three heads; the first that of a *Bull*, the second of a *Lion*, the third of a *God.* The serpent thus produced brought forth an *Egg*, which divided itself into two equal parts; the upper division constituting heaven (*Uranos*), the lower, earth (*Gæa*). From these two proceeded the primitive forces of nature.

According to the second theory, the origin of all things was *Time* (*Cronos*), who begot *Chaos* and *Ether*. The conjunction of chaos with ether formed a brilliant white egg, the *mundane egg*, which included, in some mysterious manner, the vitality of the world. This egg was fructified by the moving ether (winds), and from it emerged *Eros*, with glittering golden wings. Eros, now, as the creative spirit, called forth the gods by his smiles, while the wretched race of mortals sprang from his tears. He is also known as *Phanes*, an Orphic term signifying the first principles of the world, and is doubtless the same as *Æon* occurring in other mythologies equivalent to Time as eternal power. The lion's head of *Æon* (*pl.* 16, *fig.* 10) is emblematical of strength. The wings and birds indicate his fleetness; the serpent

symbolizes his constant renovation; the staff denotes the measuring of the centuries and years, the beginning and end of which are indicated by the key; the cluster of grapes is expressive of the fertility caused by slime; and the caduceus, the cock, the tongs and hammer at his feet testify that vigilance and industry which can improve time, but which cannot arrest its flight.

The third is the Hesiodic Theogony. According to it the prime source of all things was *Chaos*, from which emanated the primitive forces and the gods as their rulers. *Gæa* was the ancestress of the gods. She had sprung from chaos or from an egg, and first gave birth to *Uranos* (the firmament or starry heavens), the *high mountains*, and the *watery world.* After espousing Uranos she became the mother of the six *Titans* (*Oceanos*, *Coios*, *Crios*, *Japetos*, *Hyperion*, and *Cronos*), the six *Titanides* (*Rheia* or *Rhea*, *Mnemosyne*, *Themis*, *Phœbe*, *Thetis*, and *Theia*), and the *Cyclopes* and *Hecatoncheiri* (the hundred-handed).

Uranos becoming fearful that his children would grow too powerful and aspire to supreme dominion, chained them and then banished them to *Tartaros*, but Gæa, provoked at his cruelty, incited the Titans to conspire for his overthrow. Cronos the youngest, who alone had sufficient courage to make the attack, obtaining from his mother a diamond sickle as his weapon, dethroned his father. He now became ruler of the universe, and ascended the throne of Uranos (*pl.* 16, *figs.* 11, 12). He married Rhea, one of the Titanides, by whom he had three sons, *Aïs*, *Poseidon*, and *Zeus*, and three daughters, *Hestia*, *Demeter*, and *Hera;* but fearing the realization of the prophecy of Themis, that his sons would imitate his own example and rebel against him, he devoured all the children except Zeus, who escaped through the artifice of his mother. When he was born and seemed likely to perish like the rest, Rhea enveloped the stone *Abadyr* in a goat skin, and Cronos swallowed it (*fig.* 13) instead of the infant, which was sent to Gæa, to be reared in Crete. He was suckled by the *goat Amalthea* (*fig.* 17), whose horn afterwards became the symbol of plenty. Rhea sits close by dejected, and apprehensive lest Cronos should discover the retreat, with her veil she wipes away her tears. Two *Curetes* (mysterious beings, supposed by some to be demons or servants of the gods, by others regarded as the children of Zeus) dressed in the *chlamys* or warrior's cloak, and equipped in helmets and armor, practise the war-dance before Zeus, and by striking their swords upon their shields keep up a perpetual din, in order to prevent Cronos from hearing the cries of the child. According to another myth Zeus was nourished by the *nymph Amalthea*, daughter of king *Minos*, with nectar and ambrosia from two rams' horns. As a mark of gratitude he afterwards placed one of the horns among the constellations, and changed the other, which Amalthea retained into the *cornucopia* or horn of plenty, containing every commodity that can be desired. After he grew up he resolved to dethrone his father, and thus avenge the injuries of his youth. This involved him in a war with the Titans. The latter had been consigned by Uranos to Tartaros, but were subsequently released by Cronos to assist him in the revolt against his father. Cronos

found them to be excellent allies but turbulent subjects, and was compelled to remand them to their confinement. Zeus liberated them a second time, and by their aid constrained Cronos to restore his devoured children, together with the stone Abadyr (afterwards preserved and known at Delphi as the *sacred stone*), and even sought to wrest from him the universal sovereignty. The Titans at this point assisted their brother Cronos, but Zeus, with the assistance of the Cyclopes and Hecatoncheiri, whom he liberated from Tartaros, conquered and hurled the faithless Titans once more to the infernal regions (*pl.* 18, *fig.* 2). During this contest the gods were stationed on mount *Olympus*, while the Titans occupied the opposite mountain *Othrys*.

Another war followed the accession of Zeus. The giants rose against him and his race, and sought to depose him from his authority. They piled mountain upon mountain in order to scale Olympos, hurled vast rocks at the gods, and shook the earth with their shouts of battle. The strife continued long and fierce, but Zeus showered upon them the thunderbolts forged by the Cyclopes, and at last plunged them into the abyss below.

Gæa, exasperated at the defeat of her children, now brought forth *Typhon*, a monstrous giant, to contend with the gods. Fire flashed from his mouth and eyes, serpents hissed from his hands, and a number of the gods in dismay took flight. Zeus finally overcame him and placed him in the lower world, where, uniting with *Echidna*, he became the sire of the three-headed dogs, *Arthrus* and *Cerberus*, the *Lernæan Hydra*, the *Chimæra*, and several other monsters.

This terminated the war of the gods, of whom Zeus now became the sovereign. His family succeeded that of Cronos, to whom he assigned the government of *Elysion*, situated upon the furthest ocean, where he represents antiquity, and is the ruler of the uninterrupted golden age.

Before entering upon a specific discussion of the new dynasty, it may be proper to devote a brief space to some of the personages already mentioned, as we shall not have occasion to refer to them again.

Gæa, the primeval mother of the original line of gods, after their subjugation, did not wholly disappear from the rank of mythical beings. Temples were erected, and honors paid to her as the *Great Goddess* and *Child-nourisher*. She was appealed to in oaths, and as goddess of the earth was blended with other deities of the new system.

From the wound inflicted by Cronos upon his father Uranos, drops of blood fell into the sea; and out of these sprang the *Giants*, the *Erinnyes*, the *Eumenides*, and the *Melian nymphs*.

The *Giants*, of whom we shall speak more at large hereafter, were monsters of enormous size and almost invincible strength. Their appearance was rendered frightful by their long hair (which fell in disorder over their cheeks), and their dragon's feet and tails; and in their battle with the gods they were subdued more by ingenuity than by power.

The *Erinnyes* (*pl.* 23, *fig.* 14), called *Alecto*, *Megæra*, and *Tisiphone*, were the avengers of murder, perjury, and capital offences; in other words they executed the decrees of *Nemesis*, the impersonation of divine wrath. The

artists represented them as hideous, broad-faced women, dressed in black, with projecting tongues, clawed fingers, blood-shot eyes, streaming dishevelled hair, and carrying a blazing torch or a bundle of serpents. Sometimes they appear with snakes instead of hair. They continually pursued the guilty culprit, scourging him with serpent whips until he sank to despair, and sought refuge from their fury in suicide.

The *Melian Nymphs* (nymphs of the ash tree) were a species of Dryad. At their birth the oak and fir sprang up from the ground, and will wither and die with them.

Uranos, the progenitor of all these deities, disappeared from the new dynasty of gods, receiving no further worship or honor.

Rhea, as the parent of Zeus, and the grand maternal source of the new race of gods, was included among them under the name of *Cybele*. She was represented (*pl.* 16, *fig.* 14) as a beautiful woman sitting upon a throne, or riding in a chariot drawn by lions clad in a tunic girt around her waist, while a full flowing mantle reaches from her shoulders to her feet. On her head rests the mural crown, so formed as to exhibit a wall with towers and gates. Her left hand is lying on a tambourine. We see a profile of her bust, the head and neck covered, on a coin (*pl.* 17, *fig.* 3).

Originally Rhea and Cybele constituted two separate beings, the first springing from Crete, the second from Phrygia. According to Diodorus, Cybele was the daughter of King *Mæon* and his queen *Dindyme*. In consequence of a prediction, her father caused her to be exposed on Mount Cybelos, where she was suckled by panthers and lionesses until discovered by an old shepherdess, who brought her up and called her Cybele. Her skill in the healing art secured for her the affection of the people. She invented the cymbal, the drum, and the many-tubed flute, and by reason of her discoveries and benevolence she obtained the appellation of "Good Mother of the Mountain." A beautiful youth named *Atys* (*pl.* 16, *fig.* 15) was her constant and devoted lover. Whence Atys came, who he was, and what fate finally overtook him, are questions which the myths decide variously. In regard, however, to his end, the most current account relates that when Mæon became apprised of his daughter's fame, he hastened to acknowledge her; but hearing of her intimacy with Atys, put him to death. Cybele, whose grief deprived her of reason, accompanied by her friend and tutor Marsyas, now roamed to the sound of the pipe and drum which she had invented, over many countries, visiting even the Hyperborean nations, and everywhere teaching mankind the art of agriculture. In consequence of a dreadful famine which ravaged Phrygia, and at the command of the oracle, which had been consulted in regard to the general calamity, she, or according to others Atys, obtained divine honors, his likeness being buried to stay the devastation of the famine, and public worship being decreed to him at Pessinus. The worship of Cybele and her chief festival stand, therefore, in close connexion with her relation to Atys.

The celebration of her rites began with the spring, and was partly solemn and partly wild and licentious. During the first day, March 21st, a fir was cut down and borne, with the image of Atys suspended from its branches,

into the temple of the goddess. The second day was devoted to constant mournful music on horns and other instruments. On the third, the day of rejoicing, the armed priests of Cybele, called *Cybelines* or *Corybantes*, performed wild frantic dances to the clamorous music of cymbals, drums, pipes, and horns; or ran yelling over hills and valleys with pine torches in their hands, scourging and lacerating themselves in honor of the goddess. The ceremonies of the first day, particularly the transplanting of the pine tree into the temple, were designated by the expression, *Arbor intrat!* and the whole festival symbolized the search and discovery of Atys. The emblems of Atys were a straight and a curved flute (*pl.* 16, *fig.* 16 *a*), and a shepherd's staff, together with bells (*fig.* 16 *b*).

Oceanos, the first born among the Titans, did not join the rebellion against Uranos, and thus escaped the punishment which consigned them to Tartaros. He received the government of the sea. In the rude ages the term Oceanos signified a powerful stream of water surrounding the earth, and branching off into bays and gulfs. One of the arms, the *Styx*, flowed into the lower world. Oceanos was a peaceful, good-natured god, but did not pass over into the new race of gods, being always regarded as an allegorical personage. The rivers *Acheloos*, *Alpheus*, *Asopos*, *Eridanos*, *Inachos*, *Cephissos*, *Ladon*, and *Peneus*, were his sons. He had by his union with the Titanide *Tethys* three thousand daughters called *Oceanides*.

Iapetos, another Titan, occupied a middle position between the human and the divine. His most celebrated sons were *Atlas* and *Prometheus*, who will be mentioned hereafter.

After these elucidations we resume our account and pass on to the descendants of Cronos.

The Cronides, or New Race of Gods, embraced a vast number of individuals whose proper qualifications, attributes, and character, owing to the confusion and contrariety in their history, are difficult to determine. We state nothing dogmatically upon the subject, preferring to follow the narration and arrangement most generally received.

1. Superior or Olympic Gods.

There were twelve who received the appellation of Olympic Gods from Mount Olympos, where they were supposed to meet in council and debate upon divine and human affairs. They composed one family, consisting of two brothers (*Zeus* and *Poseidon*), three sisters (*Demeter*, *Hera*, and *Hestia*), four sons (*Apollo*, *Hephæstos*, *Ares*, and *Hermes*), and three daughters (*Artemis*, *Pallas*, *Athene*, and *Aphrodite*). The number, twelve, had probably some reference to the division of the year into twelve months.

1. Zeus (Jupiter). At the termination of the celestial war already described, a new era of universal government began under Zeus. He was the Almighty, the Father of gods and men, ruler of the universe, and the chief of the Olympic council. It belonged to him to exercise

unlimited sovereignty over the other gods, to chastise them, and even to banish them from Olympos. He was the thunderer, the cloud-gatherer, the god who darted forth the lightning, who sent rain, dew, hail, snow, and wind, and who spread out the rainbow. He appointed the life and destiny of mortals, elevated and dethroned kings, dispensed good and evil, wealth and poverty, happiness and misery, life and death. He rewarded virtue and punished wickedness, guarded the rites of hospitality and the sacredness of landmarks, and directed his wrath against perjury. He selected, as the media of his communication with mankind, the oracle, the flight of birds, and the signs and omens of the sky. At the nod of his head, or the winking of his eye, the heavens trembled. Olympos constituted his permanent residence. Here he assembled the gods around him. As the source of all power and wisdom, he was the reputed father of nearly all the inferior deities, the remainder being regarded as his servants.

It must be obvious that the representations of Zeus were many and varied. The lofty ideas entertained of him, the extensive sphere he was supposed to fill, and the peculiarities of the countries and nations in which his worship was established, would argue this. Mythology presents us with a triple Zeus: the *Cretan*, the *Arcadian*, and the *Dodonæan.* In every country the artists endeavored to portray in his countenance majesty, strength, wisdom, and paternal benignity. The forehead was open and expansive; the massive hair, gathered in curls, descended on both sides to the shoulders, while the dense flowing beard, large nose, eyes, and mouth, communicated to his whole appearance the perfect ideal of a god. *Pl.* 16, *fig.* 21, represents him seated on his throne as king of the gods. His right hand holds the thunderbolts, his left the sceptre; while the eagle, one of his attributes, crouches at his feet. In *pl.* 18, *fig.* 1, we have a bust of Zeus as king, crowned with the laurel, and the expression of his face answering his generally adopted characteristics. He sometimes appears on coins (*pl.* 17, *figs.* 7 and 8), in the character of a warrior, crowned with a laurel or oak wreath, but always expressing the highest dignity. The old *Pelasgian Zeus* (*fig.* 9) differs somewhat from the foregoing. Standing erect, his hair less curly, and his person partially covered with a mantle, he grasps in one hand the thunderbolts and in the other the sceptre. *Fig.* 5 represents *Zeus Hellenios*, the national god, protector, and type of the Greeks while opposing the barbarians in Sicily; and *pl.* 16, *fig.* 20, the *Olympian Zeus*, the epitome and concentration of all his perfections, dignity, and efficiency.

Sometimes, and particularly upon coins, he is represented in a simple form, accompanied by the eagle (*pl.* 16, *fig.* 22, and *pl.* 20, *fig.* 21). Again in *pl.* 23, *fig.* 2, and *pl.* 16, *fig.* 19, he appears as the ram on the mountains or sky, or as the god of flocks and light, under the title *Zeus Ammon*, or *Hammon*, with rams' horns, which clearly point to his Egyptian origin. The ram (*Aries*), the first sign in the Zodiac, is obviously an astronomical allusion. Accordingly another legend makes Zeus a planet, and as such in the sign of Sagittarius, upon whom he is seated with the eagle and sceptre (*pl.* 18, *fig.* 4). This archer was the son of Cronos and the nymph *Philyre.* In order to prevent the jealousy of his wife Rhea, Cronos when visiting the

nymph changed himself into a horse, and this form so impressed her imagination that her child was half man and half horse.

Cheiron (for so the Centaur was named) inherited the intellectual powers of his father; soon exhibited remarkable knowledge and skill, particularly in music, astronomy, prophecy, and medicine; and was well versed in all the arts and sciences. Profound reverence for the gods and a cordial love of mankind were his prominent characteristics, and he devoted himself with zeal to the instruction and accomplishment of talented youths. With this design he lived secluded from the world on Mount Pelion, and left his retirement only when the interests of men required it. Indeed he was unusually loved and revered not only by men but even by the gods, who deemed it not inconsistent with their rank to accept his advice and instruction. At last he experienced a tragical fate. *Heracles* had waged war with the Centaurs, some of whom, being hard pressed, fled to Cheiron. One of Heracles's arrows accidentally struck him in the knee, inflicting an incurable wound. In vain did the hero apply the remedies invented by himself; the venom of the Hydra could not be neutralized. The sufferer retired to his cave and longed for death, but could not overcome his native immortality. At length Zeus took compassion on his woe, and transferred his deathless nature to *Perseus*. Cheiron was then placed among the stars, where he continues to shine in the constellation Sagittarius.

The *Centaurs* just mentioned were a race of monsters who possessed the head, arms, and breast of a man, but from the waist took the form of a horse (*pl.* 30, *fig.* 19; *pl.* 29, *fig.* 22). It is supposed that these fabulous configurations were intended to represent a race of wild mountain rangers that lived almost constantly on horseback, and delighted in the chase of wild cattle, and that they are the symbols of perfect horsemanship.

Mythology makes Zeus the hero of a number of adventures connected with the origin of the inferior gods and of the heroes, and allegorically accounting for their extraordinary qualities by representing them as the children of Zeus himself.

The first of the favorites of Zeus was *Niobe*, daughter of the river god *Inachos*. Her daughter *Io*, priestess of *Hera*, the ever jealous consort of Zeus, also excited within him the tender passion. In order to shield her from the wrath of his consort, he changed her into a white cow. Hera still suspecting the fidelity of her spouse, requested the cow as a present, and placed over her as a guardian the all-seeing *Argos*, a giant with a hundred eyes (*pl.* 20, *fig.* 1). Zeus, however, outwitted them both. Despatching *Hermes*, the messenger of the gods, to liberate the captive, the god of cunning changed himself into a shepherd, and seeking a position near Argos, produced upon the flute such soft and soothing tones that all the eyes were closed in sleep. Approaching Argos from behind, he killed him with a stone and released the cow. Hera saved the eyes of Argos and set them in the tail of the peacock, and sent against Io the gad-fly *Oistros*, the tormentor of cattle, which drove her through various countries, compelled her to swim the Bosphorus, and finally suffered her to rest in Egypt, where she was worshipped under the name of *Isis*.

Another object of Zeus's affections was *Leda*, wife of *Tyndaros*, king of Sparta. Charmed by her extraordinary beauty, yet denied access to her in mortal shape, he changed himself into a swan which became her favorite (*pl.* 20, *fig.* 2), with whom she produced an egg, from which in due time emanated the celebrated twin brothers *Castor* and *Pollux*, or the *Dioscuri*, who will be mentioned hereafter.

Leto (Latona), the daughter of *Coios* and the Titanide *Phœbe*, in her attachment to Zeus, was exposed to hardships and sufferings not less severe than those of Io. The ever suspicious *Hera* constantly persecuted her, and prohibited the inhabitants of the countries and islands through which the trembling fugitive passed, under the most dreadful threatenings from entertaining her. Pursued by the hideous serpent *Python*, she wandered over all lands, obtaining during only a part of the night a brief respite from the monster. At a pond in a village in Lycia, the inhabitants refused her the privilege of slaking her burning thirst, and pursued her with clubs; and Zeus in revenge turned them into frogs. At the solicitation of Zeus, *Poseidon* brought up from the sea the island of *Delos*, and permitted her to occupy it. Here she brought forth *Apollo* and *Artemis*. The infant Apollo was wrapped by nymphs in costly bandages, and was fed by *Themis* with nectar and ambrosia, which so strengthened him that he burst asunder the bandages and threw them aside, and seized his bow and arrow to protect his mother and sister. The serpent Python in the meantime renewed his persecution, and Leto fled with her twins to Mount Parnassos (*pl.* 20, *fig.* 5.) Here Apollo slew the serpent, and cast him into a dark cavern. Long after, when a temple was erected on this spot to the honor of Apollo, the vapor which issued from the chasm served to inspire the priestesses of the celebrated oracle.

Europa, daughter of king *Agenor* of Phœnicia, and of the nymph *Telephassa*, also attracted the attentions of Zeus. A box of cosmetics which she had received from one of Hera's maids so heightened her charms as to move the heart of the king of gods and men. In order to approach her safely, he changed himself into a beautiful bull, and advanced to the seashore where Europa was gathering flowers with her companions (*pl.* 20, *fig.* 22). She found the bull so beautiful and gentle that she ventured to mount upon his back (*pl.* 18, *fig.* 3), when the disguised god ran off with his lovely burden to the seas (*pl.* 17, *fig.* 10), and swam across to the island of Crete, where he transformed himself into a handsome youth, who inspired her with love, and to whom she bore three sons, *Minos*, *Sarpedon*, and *Rhadamanthus*.

The most important myth connected with the history of Zeus is commemorated by *fig.* 11, which is intended to represent Zeus the moment preceding the birth of *Athene* (Minerva), who is said to have sprung from his head. After his marriage with *Metis* (Prudence), it was predicted that her child, if a son, would dethrone him. To prevent this he swallowed his spouse before her delivery. Presently he felt a pain in his head, and permitted *Hephæstos* to open it with his hammer, when *Athene* (Wisdom) sprang forth in full armor. Another legend relates that she came without genera-

tion from his brain; and a third makes her the daughter of *Poseidon* and the nymph *Tritonis*, and only the adopted child of Zeus.

2. Hera (Juno). This goddess was the daughter of Cronos and Rhea. She was the sister and consort of Zeus, and as such queen of heaven. For a while she hesitated to marry Zeus, until one day when she was promenading on *Mount Thronium* in *Locris*, he sent upon her a violent storm, and hovered over her in the form of a cuckoo. In compassion to the drenched and frightened bird, she took it to her bosom. Zeus now disclosed his true character and shape, and she then consented to become his wife.

The marriage of these deities became the source of all blessings upon earth, and is represented as the model of the marriage relation, Hera being the ideal of a Greek wife and mother. She is incorruptibly chaste, showing an unvaried matronly modesty, but also a frigid scorn and jealousy when Zeus by his infidelities disregards her rights, an exalted self-respect, and finally an almost unceasing vindictiveness against all rivals in her husband's favor. Hence the honor in which she was held as the goddess of marriage and courtship, the patroness of connubial fidelity, and the avenger of the violation of the marriage covenant. Hera's insignia were the diadem and sceptre which defined her rank as queen of heaven; the peacock, which indicated her empire in the air; the cuckoo and pomegranate; and that which marked her particularly from the most ancient times, was the veil, the assumption of which by the affianced bride indicated the devotion of all subsequent life to the husband and his interests (*pl.* 15, *fig.* 7). Some of the old Pelasgian representations exhibit her with both diadem and veil (*pl.* 17, *fig.* 13), and as the queen of heaven wearing the crown (*pl.* 15, *fig.* 6). As a mother suckling her son *Ares*, she is seen in *pl.* 16, *fig.* 23, where her whole appearance is so agreeable as greatly to relieve the ordinarily stern features of this queen of gods. Her worship prevailed extensively, and was particularly splendid in Sparta, Mycenæ, Samos, Arcadia, and Elis.

3. Poseidon (Neptune). In the distribution of universal authority, this god obtained the dominion of the sea. Originally, while the idea prevailed that the earth's surface was not only surrounded by water but rested upon it, he was regarded in a general sense as the god of the ocean, as well as of rivers and springs.

Within his own domains he ruled with an absoluteness equal to that of Zeus in heaven. He agitated the ocean to its foundations, and calmed it by a nod of his head: he shook the earth and mountains till they reeled. Accordingly, he had his own circle of inferior beings and agencies, and his own court, over whose splendor he presided. At a later period, however, he took merely the rank of sea god, and although still august and powerful, he nevertheless lacked the noble majesty of Zeus. His exterior exhibited something violent and rude, a species of defiance and discontent. The artists in their representations gave him a more slender frame, and a denser muscularity than to Zeus. His features were also sharper; the countenance contained less of openness and repose, and the hair was more bristling and disorderly.

According to the older style of representation, Poseidon appears dressed in a long garment, holding in one hand the trident, in the other the dolphin, both prime attributes (*pl.* 22, *fig.* 4); in later times either wholly nude (*fig.* 6), or partly covered (*fig.* 5). On an ancient Greek coin (*pl.* 21, *fig.* 11) he is seen holding the trident in the attitude of hurling it. The inscription marks it as the currency of *Pæstum*, a Greek town in Laconia. Not unfrequently we see him riding on a car without wheels, drawn by *hippocamps* (sea horses). A highly finished engraving of this sort, representing the triumph of *Poseidon* and *Amphitrite*, is given in *pl.* 23, *fig.* 20. They are riding over the sea, surrounded by *Nereides*, *Dolphins*, *and Tritons.* Mounted upon his car, which is drawn by four hippocamps, Poseidon moves majestically over the waters, holding the trident in the left hand and the reins in the right. He looks benignantly on Amphitrite, who is conveyed by dolphins, and employs her hands in holding the reins and one end of a veil. One nereid sits on her right side, supporting her uplifted arm; another is seen on the left holding the other end of the veil and guiding one of the dolphins. Joyous tritons surround them on all sides, blowing in their ocean shells; and Cupids or genii are lying or sitting upon dolphins. Further off appear other nereides or sea gods who regard Poseidon as their sovereign, while Cupids hover above the scene, strewing flowers or shooting love arrows.

Amphitrite, as intimated above, was the wife of Poseidon. She was the daughter of *Oceanos* and *Tethys*. During the war of the Titans Poseidon had signalized his hostility to her race, and remembering this fact, she spurned his first efforts to woo her, flying from his presence, and hiding herself among the sea weeds. A dolphin pointed out to him the place of her concealment. Pursuing her thither he renewed his addresses, and succeeded in overcoming her objections to the union, and in gratitude placed the dolphin among the constellations. Amphitrite, now queen of the sea, lived with her husband in a golden palace at the bottom of the Eubœan strait.

Poseidon, like his relation Zeus, proved unfaithful to his spouse; indeed the myths make him the more gallant of the two.

The most celebrated among his favorites was the fountain nymph *Amymone*, for whose sake he watered the thirsty plains of *Argolis*, a fountain being opened on the spot where the god first saw her. The interview is represented on a coin (*pl.* 23, *fig.* 4). Poseidon stands before Amymone in the act of declaring his love, with his right foot on a stone, his right hand on his knee, and the left placed on his back; while she holds a pitcher in the right hand, and covers her eyes with the left, her half-averted face and abashed look marking her inward agitation upon the question of rejecting or accepting his proposal.

It is remarkable that notwithstanding Poseidon's posterity displayed a wild ungovernable propensity, they should nevertheless furnish so many heroes and founders of states and cities. Among these we mention only *Taras*, who appears on a Tarentinian coin (*pl.* 21, *fig.* 10) riding on a dolphin, holding a trident and a statue of victory. He was founder and

patron god of Taras (the ancient name for Taranto), and the figure as well as the inscription ΤΑΡΑΣ obviously point to that historical fact.

Poseidon and *Pallas Athene* contended with each other about the sway of the city of Athens, and the honor of giving it a name. It was agreed to decide the dispute in favor of the one who should produce the most valuable gift for the Greeks. Poseidon struck the ground and the horse arose; Athene created the olive tree. The Greeks thereupon chose her for their patron deity, and called the city *Athens.* In *pl.* 21, *fig.* 12, representing this transaction, she is seen extending her right hand to Poseidon, in token of her joy at the happy termination of the contest. The owl is sitting on a branch of the olive, around whose trunk coils the serpent, one of the insignia of Athene. Owing to Poseidon's gift in his contest with Athene, horses were ever afterwards sacrificed to him, together with seals; and horse-races in honor of him constituted part of the exercises connected with the Isthmian games. Merchants and navigators made frequent offerings to Poseidon.

4. Demeter, or Dio (Ceres). This goddess was the daughter of Cronos and Rhea, and the patroness of the vegetable world, particularly of fruits and grain. At an early period she appears to have been distinguished from *Hestia*, or *Vesta*, the latter impregnating the earth with fertilizing warmth, the former inducing, shaping, and maturing the nourishing ear. She founded agriculture, reclaimed mankind from a savage state, accustomed them to permanent residences, and taught them the rights of property.

In statues and paintings she resembles *Hera* in the maternal expression, though she is of a milder countenance, and somewhat taller. The eye also is more closed, and not so penetrating; the forehead is lower, and instead of a diadem she wears a single bandage, or a crown composed of ears of wheat. The ancient Pelasgi represented her (*pl.* 24, *fig.* 1) in full attire; the crown rests on her brow, the left hand holds a sceptre, the right a bunch of wheat ears, poppies, and flowers; while a large veil, covering the upper part of her head, falls down upon her back. The later Grecian artists, however, exhibit her entirely naked, with a fruit basket and a sheaf of grain. Many busts of the goddess have the crown of ears (*pl.* 24, *fig.* 2), or instead of it, the hair put up in a waving form, with a tuft or bunch on the top of the head (*pl.* 18, *fig.* 16).

Demeter was visited by Zeus in the shape of a serpent; and she is seen on a coin (*pl.* 15, *fig.* 27 *a*), shuddering at the sight of the serpent, and endeavoring to escape from it, while the *reverse* of the same coin (*fig.* 27 *b*) represents Bacchos with the body of a bull, the son of Zeus and Demeter. Some writers, however, interpret these figures of *Zeus* and *Persephone* (Proserpine). The latter, whom the common myth describes as the daughter of Zeus and Demeter, was the source of much grief to the mother. While yet a child, her father had betrothed her to her brother *Hades*, the gloomy prince of the infernal world, but when she grew up she declined fulfilling the engagement. As she was one day gathering flowers in the Mysian plain in the absence of her mother, the earth opened suddenly, and Hades arose in his golden chariot and carried her off through a cave to his shadowy

abode. Demeter heard her shrieks, but arrived too late to rescue her from the ravisher. Lighting a torch at Etna, she mounted her car (*fig.* 26 *a b*) and wandered over the world in search of her daughter, but did not find her. After nine days and nights' fruitless effort, she learned from *Helios* (the sun), the all-seeing, both the fate and the habitation of Persephone. In grief and rage she cursed the earth for assisting in the escape of the ravisher, denied herself food and drink, renounced her divinity, and in disgust abandoned the society of the gods.

In vain did Zeus send *Iris* and others to recall her to Olympos, and induce her to revoke her malediction upon the now sterile earth; she remained inflexible until she secured the promise of having her daughter restored. Zeus despatched the divine messenger *Hermes* to *Erebos* (the lower world), to bring back Persephone; but Hades had induced her to eat with him a pomegranate, and this bound her to his domains. Zeus, however, so modified the penalty of her indiscretion as to allow her to pass eight months of the year with her mother, and the remaining four with her husband. Gratified at this concession, Demeter now forgot her resentment, revived the fertility of the soil, promoted husbandry, and for this purpose visited the kings of the earth, showing herself particularly communicative to *Triptolemus*, King of Attica. She taught him to use the plough (*pl.* 23, *fig.* 18), and presented him with a chariot drawn by winged dragons, in which he rode over every country, teaching the inhabitants the arts of tillage, and the method of performing her sacred rites (*pl.* 24, *fig.* 6). After this Demeter returned to Olympos.

5. Pallas Athene (Minerva). We have already remarked that *Athene* was daughter of Zeus and Metis. She was regarded as the goddess of intellectual power, of cool, calm reason; and the poets and philosophers have assigned to her various and contradictory attributes. She presided over systematic warfare, and was supposed to be present in those contests which were decided rather by military skill than by the rude courage of the belligerents. On the other hand, she favored the reign of peace, promoted the pacific occupations of spinning, sewing, and embroidery, and patronized the fine arts so far as they contributed to mental cultivation. Accordingly she befriended poetry, oratory, and the sciences in general, taking them cordially under her special protection.

As she was not born of a mother, she exhibited no signs of female tenderness. Unsusceptible of the influence of love, she ever remained the virgin goddess, disdaining all womanly weakness; and yet this apparent incongruity between her sex and character was finely reconciled by the artists. Her eye, unlike that of *Artemis* (Diana), does not open fully, is rather steady and downcast. Her compressed lips indicate earnestness, and the whole face is rather small and elongated than full and round. The chin is prominent and somewhat sharp, the nose long and finely formed, the hair massive and artlessly drawn back from the forehead, falling loosely over her beautiful neck. In short, the whole figure is in accordance with the ideal, and the masculine character of the vigorous and compact frame is softened by the feminine expression which may be traced in all its outlines.

The customary habit of Athene is the Spartan tunic, without sleeves or seams on the sides, and over this is thrown a wide and numerously folded cloak. The *helmet*, *ægis*, and *shield* constitute her inseparable attributes. The helmet is sometimes of the Corinthian fashion, with a movable visor, sometimes like the close-fitting Attic helmet furnished with a narrow frontlet and side clasps, and always more or less richly adorned with griffins, rams' horns, and sometimes a row of horses, the front ones so arranged as to resemble a span harnessed to a war chariot. Sphinxes, also, hippogriffs, and serpents often serve to ornament it. The *Ægis* was a sort of cuirass or breastplate, made of the rough skin of a monster which Athene had killed. Its seams were united by serpents instead of cords. The term *Ægis* literally signifies a goat-skin, and Lactantius says it was made of the skin of the goat which suckled Zeus. When fitted to the person it covered the breast as far as the waist, and passing over the shoulders, extended as low behind as the front part. In some pictures it is represented as oblique, passing from the right shoulder over the breast, and after going under the left arm, crossing the back to the right shoulder. A mask of *Medusa*, sculptured in the middle, gives it a terrific aspect. The *shield* is Spartan, of a circular form, and bears on its face the usual ornaments. It did not accompany the goddess when she was represented in her peaceful character. Besides the helmet and shield, Athene occasionally appears with the snake, the olive branch, the night owl, the cock, and the spear.

After this general explanation, the various pictures of this goddess will be readily understood. As goddess of war, we see her (*pl.* 27, *fig.* 7) in her peculiar panoply, the helmet, ægis, shield, and lance; as hastening to battle, with the lance on her shoulder and the shield hung upon the lance (*fig.* 10); as *Nike*, or Victoria, the goddess of victory after a well fought battle and the subjugation of the foe (*fig.* 14). Unlike *Ares* (Mars), Athene has no fondness for war for its own sake; hence we see her (*pl.* 19, *fig.* 3) as Victoria in peace, her right hand hanging down inactive, and the left holding the upright spear.

In *pl.* 27, *fig.* 9, we have the *Agoræan Athene* wearing the Doric *chiton*, a narrow woollen garment without sleeves, suspended by bands and clasps from the shoulders, closed at the waist but open below, the whole enveloped in a sort of gown. A very small ægis hangs over the breast, the shield and lance are wanting, the right hand rests on the hip, the head inclines with a singular expression, and the left arm is performing an oratorical gesture.

Among her busts are some representing her in rich attire (*fig.* 8); others in simpler costume (*pl.* 28, *fig.* 6). The serpent stands either as the symbol of medical science, or as indicating the necessity of vigilance over young women.

Athene often appears upon coins. Thus on a brass coin of Athens (*pl.* 27, *fig.* 12 *a b*) the obverse exhibits her profile with a neat, simple helmet; the reverse shows the acropolis of Athens, the temple and statue of Athene standing on the brow of the hill, a flight of steps leading up the sides, and in the rocks the entrance to the cave of *Pan*. The inscription shows

the origin of the coin. *Fig.* 11 *a b* exhibits the bust of Athene and her sacred bird, the owl.

6. Hestia (Vesta). This goddess, the eldest daughter of Cronos and Rhea, taught men the use of fire and the benefits of social union; she also represented domestic happiness, and presided over the social hearth. In comparison with the other Olympic deities, her history is exceedingly obscure and limited, fewer monuments being found of her than of any other goddess. She is often regarded as *Cybele the younger*, the same as *Ignis* (fire).

The artists represented her with a noble form like that of Hera and Demeter, differing mainly in having a less robust appearance. Her principal characteristics were a striking simplicity of manner, and a tranquil, placid earnestness of mien, attitude, and dress. A statue expressive of these traits is copied in *pl.* 15, *fig.* 8, though some authors improperly interpret it as a Vestal virgin, one of her priestesses. Every part of the figure confirms our view of it. The general fashion of the dress, the veil, the sceptre-shaped staff, the intelligence and ideality of the head, the womanly rather than the maiden-like form, all express the goddess rather than the priestess. But few temples were erected in honor of Hestia, for every dwelling was her temple. In the middle of the house stood her altar, and the antechamber of every family residence was regarded as sacred to her.

7. Hephæstos (Vulcan), son of Hera, who had given him birth out of spite to Zeus, when he had caused Athene to spring full grown from his head, was the god of fire, and the inventor and patron of all such arts and manufactures as require heat in conducting them. He also symbolized the subterranean fires which sometimes revealed themselves in eruptions. He is represented in various forms. By ancient artists he is described as youthful and beardless. Later, however, he appears in a manly form, holding a middle position between the older and more youthful gods. The principal marks characterizing his statues are the Phrygian cap (*pl.* 24, *fig.* 20), or a conical hat, and as attributes the hammer, tongs, and anvil. As a compensation for his want of beauty and grace (for he was lame, and the only misshapen deity in Olympos), he possessed in its highest degree the inventive genius, particularly in its application to the working of metals. By the exertion of this faculty, he secured the respect and favor of all the gods. He built their palaces, forged thunderbolts for Zeus and arrows for *Eros*, and prepared the silver armor of *Ares*, the shield of *Achilles*, and other similar works. Volcanoes served him as workshops, and here he plied his profession with his fellow workmen the *Cyclopes* (*pl.* 25, *fig.* 20).

The mythological fictions give different reasons for his lameness. One relates that his mother, so soon as she saw that his beauty did not equal her own, petulantly cast him from Olympos, and crippled him by the fall. He subsequently avenged this unnatural cruelty. At the command of Zeus he constructed for his mother a golden throne-chair, and the moment she occupied it she felt invisible chains confining her firmly to the seat, until at length Ares procured her liberation. Another legend states that Zeus himself hurled him from Olympos, first when Hera was endeavoring to hide the new born god from his sight; and again when Hephæstos dared to

interfere in a quarrel between his father and mother, and espoused the side of the latter. This time he fell upon the island of Lemnos, whose inhabitants kindly received and intertained him.

At a subsequent period he expressed his willingness to return to Olympos, and *Dionysos* (Bacchus) undertook to conduct the refractory god home. Having first intoxicated him, he placed him on an ass, and amid music and acclamations bore him safely to the residence of the gods.

It was not long ere he created new troubles in the divine assembly. *Eros*, for whom Hephæstos had made golden arrows, resolved to try their influence on the artist himself. One of them took effect, and the fire god became a helpless captive to the charms of *Aphrodite*, the most beautiful of all the celestials. As the extremes of beauty and ugliness could not naturally meet in one pair, his passion remained long unreciprocated. At last the dejected lover abandoned his labors, and threatened never to resume them until she should become his wife. The other inhabitants of Olympos, whom Hephæstos had supplied with armor and other implements, now felt constrained to use their influence in overcoming her objections to the union. At length she complied, and after a magnificent solemnization of the marriage ceremonies, he cheerfully returned to his work.

8. Aphrodite (Venus). The most graceful and charming of all the female deities was the goddess of beauty. In her the Greeks expressed their most perfect ideal of female loveliness and attraction, of an all-influencing, all-subduing power, whose sphere embraced both gods and men; but as the beneficent impulse of love itself, if not carefully moderated by morality, may prove destructive of its own aims, she sometimes stands also as the symbol of this ungoverned sensuality.

In the later history of mythology, however, it was the object of artists, both painters and sculptors, to embody in her representations the most attractive female delicacy. Hence the *Aphrodite Urania* (celestial love) must be carefully distinguished from the *Aphrodite Pandemos*, or *Vulgivaga* (earthly love). As connected with matrimonial and social interests, she presided over marriages, births, and festivals, and was the protectress of children and mariners. So far as concerned the exterior development which the artists endeavored to reveal, it was handsomely realized in the delicate and finely swelling form in which beauty and modesty prevailed. The face is a lengthened oval, the forehead moderately high, the outline of the eye-brow is clear and serene, the eye small and glancing love, the mouth small, symmetrical, and charming in expression, the ridge and point of the nose elegantly chiselled, and finally, the cheeks have an agreeable fulness. The hair, gathered from the forehead and temples, reposes in graceful folds on the crown of the head, sometimes adorned with a riband. The head itself does not sit perpendicularly upon the swan-like neck, but has a slight easy inclination to one side.

In regard to the dress, position, insignia, &c., of Aphrodite, great diversity existed. This was the natural result of the almost universal homage paid her, and the innumerable attempts to represent her in every conceivable relation. On the old Pelasgian statues she appeared in full dress (*pl.*

27, *fig.* 18), her head adorned with the diadem; as goddess of matrimony (*fig.* 26) she is represented in a similar manner, only the drapery is less splendid and heavy, and the left breast and shoulder are exposed. *Fig.* 21 exhibits her as empress of the sea, partly clothed and partly exposed, her right hand resting on the tail of the dolphin, which accompanies her statues in this character; and at *fig.* 19 we see her leaning on a dolphin, entirely naked, and in the act of putting on an anklet. In a celebrated drawing (*fig.* 20) we see her riding over the sea on a sea-bull; joyous Cupids are disporting around her; one of them guides the bull by a wreath thrown over the monster's horns, a second keeps alongside on a dolphin, while a third hovers over the goddess in the air. Near the edge of this picture the artist's name (*Glycon*) is given. *Pl.* 15, *fig.* 17, represents a statue of her, very similar in attitude to the beautiful and celebrated *Venus di Medici*, in which she appears partly nude and crowned. She was also often represented bathing. Thus on a coin (*pl.* 28, *fig.* 16) she is kneeling on the ground, one Cupid is rubbing her back with a cloth while another pours water over her. In *fig.* 17, she is seen in the act of resuming her dress after a bath. As *Aphrodite Callipygos* (*pl.* 27, *fig.* 24), she appears with her tunic lifted above her hips, and her face turned round as if surveying her figure in a mirror; and as *Venus Erycina*, so called from Mount Eryx in Sicily (*pl.* 28, *fig.* 15), she is seated in a chair and attended by the dove and a Cupid. The inscription EPYK signifies "coin of the Erycinians." We present also (*fig.* 14), on a coin of Ascalon, a figure of *Aphrodite Urania*, under the name of *Astarte*, or *Astaroth*, a goddess of the Phœnicians. A crescent surmounts her head; she holds in the right hand a dove, and in the left a warrior's lance; while her whole weight rests upon the prostrate *Derceto*. This latter goddess was worshipped by the Syrians; she is half woman and half fish, symbolizing doubtless two successive periods of cosmogony. In the figure she holds aloft the horn of plenty. Among the numerous busts of Aphrodite, some exhibit her with the Junonian diadem (*pl.* 27, *fig.* 17 *a*); others with the simple hair-knot (*fig.* 17 *b*.)

The myths relating to Aphrodite equalled in number her representations. Her birth itself was extraordinary, for according to the old legends she arose from the drops of blood which fell into the sea when Cronos wounded his father Uranos. *Pl.* 27, *fig.* 31, represents the circumstances attending her first appearance. Happy Tritons are bearing over the sea on a shell the new-born pearl of creation; others proclaim on their horns their joy at the priceless gift; nymphs vie with each other in celebrating her birth, and approach her with the richest fruits; while Cupids hover over her with an ample veil, and scatter flowers on her. When she had left the deep she wrung the water from her hair (*fig.* 22), and myrtles and roses sprang up on the spot where her foot first rested on the shore. She was received in Olympos with universal acclamation, and, as already remarked, married to Hephæstos, who, however, was not blessed by her acquisition in proportion to his expectations, as she married him only reluctantly, and as the goddess of love bestowed her smiles both on gods and mortals. Thus *Ares*, the valiant war god, enjoyed her regard; and in *pl.* 18, *fig.* 5, they are seen

declaring their love. Among mortals she also had her favorites. The story of her love for *Adonis*, son of King *Cinyras*, is well known. This youth, the handsomest of men, lived on her favorite island Cyprus, and so intense was her affection for him, that she requested Persephone to endow him with immortality. The latter granted the favor, but recalled it so soon as she saw him, herself becoming enamored of his beauty; though another account says she permitted him to spend one half the year on earth, the other in the shades. The fable obviously points to the periodical return of summer and winter.

To return, however, to the first myth. Aphrodite became alarmed for his safety, as he frequently exposed himself to danger in the chase. At length the jealous Ares appeared in the woods as a wild boar, and while Adonis was in hot pursuit, turned and killed him with his tusks. Aphrodite in vain sought to restore him to life; despair, however, yielding to a gentler grief, she sprinkled water on the ground and raised from the fatal spot the flower *anemone*. Her love for *Anchises*, prince of Troy, was inspired by Zeus as a punishment for her boast that she was superior to the power of the tender passion. Anxious for his life, she concealed their affection; but Anchises imprudently disclosed the secret to *Dionysos*. Enraged at his presumption, Zeus hurled at him a thunderbolt. Aphrodite caught it in her garments, but terror rendered him dim-sighted and feeble. After the sack of Troy he accompanied his son *Æneas* on his voyage to Italy, but died in Sicily and was buried near Mount Eryx. Aphrodite often mourned at his grave, and placed a dove to watch it. Her beauty occasioned a contest with Hera and Pallas Athene, which arose in this manner: *Peleus*, prince of *Phthia*, had invited to his wedding all the gods and goddesses except *Eris*, the goddess of Discord, who always marred the harmony of every company to which she was admitted. Chagrined at the seclusion, she determined at any rate to gratify her ruling propensity, and threw into the marriage hall a golden apple bearing the inscription "For the most Beautiful!" The three goddesses severally claimed it, but as they could not agree upon the rightful owner, they appealed to Zeus for an award. The latter declined the office, and referred them to *Paris*, son of *Priam*, king of Troy, who was then on Mount Ida. Each candidate endeavored to obtain a decision in her own favor by bribing the umpire. Aphrodite shrewdly promised him *Helen*, the most beautiful woman of earth, and the prize was awarded to her. *Pl.* 27, *fig.* 25 *a*, represents her victorious over both competitors, and holding the apple and a mirror. She fulfilled her engagement with Paris, and aided him in the abduction of Helen, wife of *Menelaus*. The Trojan war resulted from this rape, and even Aphrodite could not avert the calamity nor protect her favorite from the destruction which it brought upon him and his race.

9. Ares (Mars). Unlike Athene, the patroness of scientific warfare, Ares, the son of Zeus and Hera, was the god of bloody battles, and represented the idea of rude, lawless violence. Ferocious and ungovernable, no employment was so congenial to his disposition as slaughter, and burying grounds and fields of carnage constituted for him the most pleasing spectacle. According-

ingly in the Trojan war he took the part of the besieged, because their rude method of fighting suited his own genius; while Athene, conducting a more open and honorable strife, assisted the polished Greeks. In later times he was regarded as a helper of mortals, a protector of the just, an avenger of innocence, and as bestowing vigorous youth. His natural rudeness rendered him disagreeable to the Olympic gods, yet during their contest with the giants he served them successfully.

A compact powerful frame, a strong fleshy neck, short and curly or bristling hair, rather small eyes, wide nostrils, and, as compared with the other sons of Zeus, a rather gloomy forehead, composed the principal features by which the artists expressed the ideal of Ares. He is usually represented without clothing, or at most wearing only the warrior's cloak. His armor consists of the helmet, shield, spear, and sword. Destructive and carnivorous animals, particularly the wolf, were sacred to him. He was also partial to the horse for his strength, and to the dog and cock for their vigilance. Among the refined Greeks, Ares was never regarded as a favorite, and received far less homage than the other Olympic deities. In Sparta, however, where war formed the chief business of life, his statue was secured by chains, so that the fortunes of battle might always be insured to the state. Very ancient works represent him with a close fitting coat of mail, tabard, greaves, spear, helmet, and shield (*pl.* 17, *fig.* 18); and *fig.* 20 shows a fine head of a bearded Ares, as seen on a coin of Metapontum in lower Italy, with the name of the magistrate *Leukippos*. A handsomely wrought bust of him exists, adorned with a sphinx and the figures of his sacred wolves (*fig.* 19). In *fig.* 21 he is seen reposing after battle, apparently enjoying a peaceful frame of mind, the shield leaning by his side and a Cupid playing at his feet.

Among the most celebrated of his numerous children we mention the twins *Romulus* and *Remus*, *Harmonia*, *Eros*, and *Phobos* and *Deimos* (Fear and Dismay), who harnessed his chariot, and in company with his sister *Eris* attended him everywhere.

10. Hermes (Mercury) was the son of Zeus and *Maia* daughter of *Atlas*, and played a conspicuous part in divine affairs. He was the god of artifice, inventions, and commerce; the patron of eloquence; and disclosed to mankind the first principles of scientific knowledge. He fostered cunning and fraud; imparted the gifts of prophecy; arranged the sites for athletic exercises; introduced the use of sacrifices; was the messenger of the gods, and their legate in their controversies with men; and at death conducted the departed souls to the world of shades. At the movement of his wand he awakened the dead or sank the living to sleep. At the judgment-seat of *Hades* he stood as either the defender or accuser of the departed, according as he was commanded by the gods. He also taught men the art of reckoning; invented weights, measures, and money; showed the nature and practice of amusing plays, and the method of strengthening the body; and, in full keeping with his character, taught the use of false games. He instructed princes in the art of concluding peace; but gave them also the mischievous power of so construing the ambiguous articles of a treaty as to

justify themselves in violating them, when it appeared their interest to do so.

Considering the multiplicity of his offices and the extensive worship paid to him, it is easy to account for the numerous and diversified modes of representing him, both in statuary and painting. In the earlier efforts of art, particularly in busts (*pl.* 21, *fig.* 22), he was represented with a flowing beard and waving locks; and the prevailing expression here is that of a teacher and propagator of religious ideas and useful knowledge. Subsequently he was ranked among the beardless and more youthful gods, and here the features of cunning and dexterity reveal themselves. The bust (*pl.* 28, *fig.* 10) shows him with short curly hair, and small ears and mouth. His physical structure is handsome and compact, and well suits the inventor of gymnastics. His attitude, gesture, and mien all mark him as the thoughtful, active, and friendly deity, with whom it would prove an easy task to accomplish any negotiation, however intricate and difficult. In short, he exhibits corporeal beauty and intellectual versatility admirably blended. In regard to his exterior, we sometimes find him entirely naked, sometimes wearing a cloak which hangs loosely over the shoulders, or is folded over the arm. His distinguishing characteristics are the wings and the caduceus. The wings were attached to his head or hat, and sometimes also to his feet or ankles; they represented the promptness and rapidity with which he accomplished his errands. The caduceus was a rod with wings at the end, and two serpents wound round it, and served as a heraldic staff or magic wand, with the aid of which he produced sudden transformations, invisibility, and sleep. Hermes often wears a hat with a low crown and a brim of various breadth; the hat belongs to him as a traveller. As the messenger of the gods (*pl.* 20, *fig.* 19) he appears in the hat and a short mantle, holding the caduceus: as *Hermes Agonios* or the Wrestler (*fig.* 20) the mantle is thrown over the left shoulder, to indicate activity in executing the commands of the gods. The tortoise on which one foot is placed refers to his invention of the *lyre*. On the coin or gem (*pl.* 27, *fig.* 5) he supports the tortoise on a disk, his own arm resting on a pillar. In the character of *Hermes the Eloquent* (*fig.* 4) he stands in the attitude of an orator. The mantle hangs gracefully on the right arm, the left arm is raised; and the stump of a palm tree close by is designed to remind us that as the discoverer of letters and numbers he recorded his earliest instructions on palm leaves. On *pl.* 28, *fig.* 7, his whole figure and bearing, and particularly the significant gesture of the fore finger, powerfully express the qualities of ready ingenuity and cool calculation; while in *fig.* 9, the ram's head in a sacred vessel describes him as the establisher and regulator of religious ceremonies. In *fig.* 8 he sits upon his mantle, which is thrown over a ram; a position which indicates his office as the protector of flocks.

Hermes was represented in different degrees of age. In *pl.* 24, *fig.* 22, we see him as a mere boy, dressed in a short leather tunic. He holds in his left hand a bag or purse, which marks him as the god of traffic. His right finger is placed on his chin, and his countenance exhibits that roguish or mischievous smile which the thought of some adroit plan might naturally

prompt. In *fig.* 23 he appears as a more advanced youth, still retaining the features of active cunning. As shown in a beautiful bust (*pl.* 27, *fig.* 2), he wears the hat, and has quite a youthful expression; also in *pl.* 28, *fig.* 11, where the face is larger. Finally, we have a representation of the *Ithyphallic Hermes* (or *Priapus*, guardian of landmarks) on a coin (*pl.* 28, *fig.* 12); and in *pl.* 15, *fig.* 15, Hermes stands on a winged globe, holding in the left hand a torch, and in the right a vessel of fruits for sacrifice.

It remains to explain the term *Hermæ* applied to terminal statues (*pl.* 27, *fig.* 3). The word *Herma* originally signified a post or pillar, and hence in sculpture a post on which a bust was placed, and which was quadrangular and diminished in circumference from the top downwards. These pillars were very common, and seem to have been first used in Athens. They were made of heights in proportion to the busts which they were to bear, and sometimes had arms and feet attached. In some instances the name appeared on the breast, in others at half the height of the pillar. The whole doubtless arose out of the ancient worship, when as yet men revered the rude images which served to describe boundaries, and as guides at cross-ways; and when the Herma received the head it became a symbol of Hermes, the god of highways and travellers. These images had wings on their heads, as the insignia of Hermes. They were also placed near the temples of the other gods, in order to indicate the office of Hermes as messenger, and in gardens and walks for ornament.

From the many myths recorded of Hermes, we make a few selections, as they seem to characterize him more accurately. From the very first he exhibited remarkable prudence and sagacity. Only four hours from his birth, he threw off his swaddling clothes, and left the grotto in which he had been born. By chance he found a tortoise, and killed it; and after boring holes through the sides of the shell, and inserting reeds or pipes, he attached to them seven strings prepared from the entrails of a sheep, and using the tones of this instrument as an accompaniment, he sang the story of his birth. Thus he became the inventor of the first stringed instrument, the lyre, which henceforth was regarded as one of his proper symbols. During a second excursion he came where the herds of the gods, guarded by Apollo, were feeding. By an ingenious device he stole fifty of the cattle, hastened back to his retreat, and discovered the art of roasting and of sacrificing. Concealing the remnants of his meal, he crept back into his cradle and gathered his clothes about him. Apollo, however, by the aid of inspiration, learned where the booty was, and went to the grotto to receive it; but Hermes stoutly denied the theft, and evinced a well-feigned astonishment that one so young should be charged with so grave an offence. Apollo now accused him before Zeus, and here he still pleaded his innocence, winking slyly at the Great Father. The latter seemed pleased with his great cunning, but ordered him to restore the plunder. When Apollo went to obtain it, he was so entranced by the tones of the lyre, that he not only relinquished to Hermes the stolen cattle, but gave him also a share of the herd for it; not, however, without making the cunning deity promise not to rob him of his instrument or his bow, nor even to come near his

residence. In consideration of this pledge Apollo presented him with the staff of fortune, appointed him god of herds, and taught him the art of divination by lots.

Hermes gave yet other proofs of his skill in thieving. On the day of his birth Hera took him in her arms, and pleased with his sprightliness, suckled him; but learning from Iris whose child he was, she angrily cast him away from her. The milk which she spilt streamed across the sky, and formed the milky way. Aphrodite now took him in her lap, and in return for her caresses he stole her girdle. He afterwards purloined the sceptre of Zeus, and while Ares was in the act of recovering it, the sly god took his sword from its sheath. As some atonement for his tricks, he performed many and valuable services for the gods, and was always prompt in fulfilling their commands and requests. He evinced great fondness for the gentle sex, and had numerous descendants. While enamored of *Herse*, daughter of *Cecrops*, his modesty prevented him from declaring his passion. He then tried to influence her sister *Aglauros* in his favor, but incited by envy, she increased Herse's prejudices against him. In revenge for her treachery he changed her into a yellow stone, and ever since yellow has been regarded as a type of *Envy*.

11. Apollo. This god, the son of Zeus and *Leto*, and the twin brother of Artemis, fostered the arts of poetry, music, and divination. From his skill in archery he received the surnames, the Far-shooting, the Dragon-slayer, and others. He was also regarded as the founder of medical science, and to him and to his sister were assigned the arrows of pestilence; whence the common opinion that all who died suddenly had fallen by the arrows of Apollo. Shepherds revered him as the god of flocks, and many cities claimed and honored him as their founder and patron.

In regard to artistic representation, this god involved the perfect ideal of human beauty, and was the personification of manly youth and vigor. He belonged to the beardless gods, and none of the Olympians had so oval a face, so finely pencilled eyebrows, and so elevated a forehead. His whole countenance expressed the height of tranquil inspiration. His long, waving hair is usually fastened back, only a few stray locks descending to the shoulders, the rest being gathered in a knot on the crown of his head, like that of Artemis and Aphrodite. In the best statues his entire figure strongly reminds the observer of the Great Father, and might be mistaken for a youthful Zeus.

His many representations exhibited him in varied dress and character. Among his symbols occur the bow and arrow, because he kept the arrows of sudden death, and joined his sister in the chase; the lyre or some other musical instrument; the serpent which typifies his killing of *Python*, and his discovery of medicine; the shepherd's crook, the tripod, the laurel, the ram, and the hawk. As *Delphian Apollo* (so named from his celebrated temple at Delphi, in Phocis), he is totally destitute of drapery, and leans against an altar, holding in the left hand a laurel twig, the right being placed on his head (*pl.* 27, *fig.* 15). As *Musagetes* or leader of the Muses, he usually wears a long tunic. In this character he is represented as play-

ing the Phorminx, an ancient stringed instrument resembling the modern harp (*pl.* 28, *fig.* 4); or holds some other instrument (*pl.* 15, *fig.* 11). As *Nomios*, the pastoral god, he is seated on a rock, tending the flocks of king *Admetos;* the mantle is spread beneath him, the lyre in his right hand, and near him the shepherd's crook (*pl.* 28, *fig.* 2). We have also copied a beautiful bust of this god (*pl.* 28, *fig.* 1), where the hair is heavy and long; and another (*pl.* 18, *fig.* 14) in which the hair is parted and lies close to the head.

The myths of Apollo rank among the most interesting of antiquity, and many incidents connected with his history have been made the subjects of excellent works of art. We have already described the peril attending him while *Python* pursued his mother Leto, and now only add that while he sat with his sister on the arm of the trembling fugitive, he reached with his little hand for the monster as though it were a toy (*pl.* 20, *fig.* 5). His first employment was that of a herdsman. While a boy he tended the sacred cattle of the gods, and at a later period the horses of *Eumolos*, and the cattle on Mount Ida. For a long time also after his expulsion from Olympos by Zeus, he guarded the cattle of *Admetos* king of *Pheræ*, and during this time rendered his master important services. The king loved *Alcestis*, daughter of *Pelias*, but could obtain her only on the condition of visiting her in a chariot drawn by a lion and a boar; and Apollo taught him how to tame and harness these animals, when he received his bride from the astonished father, and formed with her a happy alliance.

While young, Apollo had the misfortune accidentally to kill two of his best friends. *Hyacinthos*, son of king *Amyclas*, was his favorite, with whom he frequently practised in games of skill. *Pl.* 28, *fig.* 3, represents the noble boy leaning against a tree, and near him his divine friend. Once, however, while they were exercising with the quoit, *Zephyrus* (west wind), who envied the boy the favor of the god, turned aside the disk of Apollo, so that it struck Hyacinthos on the temple and killed him instantly. Inconsolable at his loss, the god caused the *hyacinth* to spring up and bloom on the spot where his favorite fell.

His other friend, *Cyparissos*, had tamed a doe which he prized very highly. Apollo, while hunting, either through mistake or ignorance shot it, whereupon Cyparissos died of grief. Apollo immediately changed the friend for whom he mourned into a *cypress*, and this tree has ever since been regarded as the symbol of grief for departed loved ones.

While most of Apollo's numerous love-suits proved fortunate, some were disastrous. Among others he strongly loved *Coronis*, the sister of *Ixion*, the most lovely of the Thessalonian maidens, and felt assured that she reciprocated his passion. By means of the prudent raven, of whose prophetic powers Apollo availed himself, and which is represented perched on the lid of the caldron on the sacred tripod (*pl.* 17, *fig.* 28), he discovered that Coronis was deluding him, and secretly favoring *Ischys*, son of *Elatus*. In a fit of exasperation he slew the faithless one with an arrow, and because the raven had not earlier warned him of the deception, or else persisted in its silence, he changed his white plumage to black. Not less unpropitious

was his love for *Daphne*, daughter of the river god *Peneus*. She did not return his affection, but sought to escape from his presence, and when he pursued her addressed herself for protection to Zeus. Immediately her foot sank into the ground spreading out in the form of roots, her arms raised in supplication were changed to boughs, her fingers became twigs, and her hair green leaves, and when her impetuous lover came up to her she had already been transformed into a laurel-tree (*pl.* 17, *fig.* 26). Apollo embraced the trunk, and adopted it for his favorite tree.

Apollo enjoyed unusual celebrity for musical skill. After receiving from Hermes the lyre, he invented the cithara, and learned from Athene how to perform on the flute. While playing on this instrument in the divine assembly, Athene was derided for the swelling of her cheeks, and in a fit of rage threw it away. A Phrygian herdsman or satyr, *Marsyas*, found it, and by diligent practice soon became proficient in its use. In *pl.* 25, *fig.* 9, we see him giving instructions to his pupil *Olympos*. Proud, however, of his fancied superiority, he challenged Apollo to a musical contest, asserting that the flute was a more perfect instrument than the lyre (*fig.* 8). The god accepted the challenge, and the Muses were appointed to decide on the merits of the performers. When Marsyas played the flute the Muses danced; but when Apollo played the lyre and accompanied its notes with songs, the Muses stood enraptured and motionless. Marsyas now objected that the singing compensated for the defects of the lyre; but Apollo inverted the lyre and dispensed with the singing, and still charmed the listeners. As Marsyas could not produce such an effect, and besides could not sing and play at the same time, of course the decision was in favor of his adversary, who flayed him alive as a punishment for the presumption of contending with a god, and tied him to a tree, suspending the flute from one of its branches, and all the prayers and supplications of Olympos could not procure pardon for his vanquished master (*pl.* 20, *fig.* 7).

The sun god, *Helios*, bears a strong resemblance to Apollo, and is sometimes regarded as identical with him. He was the son of *Hyperion*, and was represented in the form of a young man. From his head issued rays; a ball, the symbol of the world which he illuminated, was supported by one hand and a cornucopia by the other, indicating the fertility and productiveness which he caused. At his feet are his horses *Aëthon* and *Pyroïs* (*pl.* 20, *fig.* 13). He was also regarded as the god of time, who kept sacred herds of cattle and horses, which he counted daily, and whose number exactly equalled the days and nights of a lunar year. His chief occupation was to guide across the sky the sun chariot drawn by the four fairy horses. He led them out each morning from the eastern gates of the horizon over an oblique arch to the gates of the west, and thence during the night to eastern Ethiopia, where he bathed his horses in the glittering sun pool. Thence he returned to his residence, *Colchis*, whence the next day he resumed his fiery course. In later times this god was united with Apollo, and was reverenced under the name *Phœbus*, or *Phœbus Apollo*. In this character we see him represented (*pl.* 26, *fig.* 11) directing the horses of the sun, and accompanied by the *Hours* or *Seasons*.

The present is a fitting place to mention *Cœlus*, a god of the physical universe, who ruled in conjunction with *Helios* or *Sol*. He was a symbol of the firmament and is represented as an old man dressed in a wide flowing tunic. He rides through the upper air, holding a veil, and occupies a position between the radiant head of Helios and Semele, who bears on her head a new moon. Greater and smaller stars shine between them (*pl.* 17, *fig.* 2).

12. Artemis (Diana). This goddess completes the Olympic circle. According to the common myths she was the daughter of Zeus and Leto, and the twin sister of Apollo. The sphere of her operations equalled his in variety and extent, and it is even more difficult to characterize her precisely, as she not only represented both ancient and later ideas, but indeed three originally distinct mythological beings.

The legends relate that when a child she was sitting in the lap of her father Zeus, and that at her request he gave to her perpetual virginity, the property of having many names, the lighted torch, Cretan maid-servants, and a city. Her province extended over earth, heaven, and the lower world. As Artemis proper, she loved the chase and presided over that profession. She obtained as her retinue sixty nymphs (*pl.* 18, *fig.* 9), and possessed the power of causing fruits and flocks to flourish, and of prolonging life, and was the protectress of roads and settlements. She next received armor from the *Cyclopes* and dogs from *Pan*, harnessed to her chariot four stags with golden antlers, and slew wild animals. She also put women to death, and all who died suddenly were said to have fallen by her arrows, just as the men expired by the arrows of Apollo. From all this will be seen her grave, masculine, and almost cruel character. Accordingly the ancient artists gave to her representations a remarkable resemblance to those of Apollo. Thus she had the same light, slender form, the same elongated oval of the countenance, a high forehead, bright eyes glancing freely around her, braided hair fastened behind, and only a few stray locks falling down over the neck.

As mistress of the chase, she wears her dress tucked up. The tunic is secured or gathered above the knee and fastened to the hips, to avoid the hindrances which longer garments would cause in hunting; the cloak is laid in a long fold and fastened over the shoulders, around the body, to give freedom to the arms; the feet are protected by buskins; on her back she carries the quiver, in her hand the bow or javelin. In *pl.* 20, *fig.* 14, one hand appears on the quiver as if taking out an arrow to intimidate Heracles, while with the left she grasps a hind which she has wrested from him. Less frequently as huntress she appears in long clothes, as on the cameo (*pl.* 27, *fig.* 1), where, for better recognition, she is seen with the bow in her hand and near her the stag.

The second principal office of Artemis is to direct the shining orb of night, the moon; and in this character she has the name *Selene*. As such she appears in a full robe flowing to the feet, and over it is thrown the *peplum*, a wide sash, which extends to the hips. Over her head flows the sail-formed veil, and the crescent moon appears either near her or connected

with her person. Sometimes, particularly in gems, she is represented driving horses or oxen, or riding on an ox (*pl.* 21, *fig.* 3), the upper part of her person uncovered, provided with wings, and holding an arrow in the right hand. Selene, with whom Artemis is thus blended, was the goddess of the moon in the olden mythology. She was much honored in Asia Minor, whence her worship gradually passed over to Crete.

Finally, Artemis was regarded as the empress of the lower world, and as presiding over magic and apparitions. In this character she bore the name of *Hecate*, and performed the duties of a special goddess of this name. Hecate, originally the daughter of the Titan *Perses* and of *Asteria*, or according to other myths, the daughter of *Zeus* and *Demeter*, was sometimes regarded as identical with *Persephone*. She was a terrible goddess of magical incantation, the avenger of perjury, the patroness of the chase and cattle breeding, and the protectress of flocks. She was usually represented with three heads, to signify her authority in heaven, earth, and the lower world. From this three-headed Hecate arose, at a later period, a figure with three bodies, symbolizing the union of Artemis, Selene, and Hecate, or more properly the concentration in one being of the three departments peculiar to each of these deities (*pl.* 23, *fig.* 13). The first figure holds in each hand a torch, and over her brow rests the crescent and the lotus; the second has in her right hand a key, and in the left a bundle of cords, as door-keeper and guardian of the gate opening to the world of shades; while the third holds in her right a dagger, and in her left a serpent deprived of its head.

Among the simple exhibitions of Artemis, the statue of *Artemis Soleia* (*pl.* 20, *fig.* 11) deserves notice. Here she is standing, in full dress, with the right arm elevated, and near her sits a hound. Also a coin (*fig.* 9) representing her between two pillars, one of which supports a vase, the other an animal, as *Artemis Locheia*, a name she received as presiding over child-birth. On the field of the coin appears a reed flute, while above and around Artemis are leafy twigs. Near the edge is the name ΛΟΧΙΑ. Finally, we present a figure of the *Artemis Tauropolos* (*pl.* 21, *fig.* 2 *a* and *b*). Upon the obverse we see her bust, a wreath encircling her head, and two ox-horns projecting from her shoulders. On the reverse she stands almost in full length, holding a lance or wand in one hand, the torch in the other, with an ox-horn on each side, and a *modios* or measure upon her head. The name Tauropolos and the horns she obtained from the custom of sacrificing bulls to her.

The celebrated statue of *Artemis of Ephesus* (*pl.* 21, *fig.* 1) is entirely different from all other representations. The goddess here wears a mural crown like that of *Cybele;* behind her is the *nimbus* or disk, the symbol of the moon's surface. Numerous winged figures adorn it, bearing the appearance of eagles, griffins, or winged bulls. On each arm lie two lions in bas-relief; and on her breast-plate several animals peculiar to the zodiac, as the bull, the twins, the cancer; and in the centre four women, two of whom, representing the seasons, are winged. This plate is inclosed with rows or festoons, of which the upper contains various kinds of fruits, while

the lower consists only of acorns, the earliest sustenance of mankind. Beneath these are seen numerous udders of animals, symbolizing all-sustaining nature. The lower part of the body, from the girdle to the feet, resembles an inverted pyramid, and is divided by bandages into six panels, occupied by victories, lions, griffins, bulls, and stags. On the sides are bees and flowers. A part of her garment protrudes from beneath and covers the heels. The whole figure is obviously akin to the Egyptian Isis or Rhea, since it represents Artemis both as the symbol of all nourishing nature, and of nature manifested in multifarious and ever-varying forms.

Ranking with the ever youthful goddesses Artemis always remained a virgin and unsusceptible of the tender passion. Whoever dared to entertain and express for her the sentiments of love was certain to incur her wrath. Witness *Actæon* who watched her and her nymphs bathing (*pl.* 20, *fig.* 15), and whom she changed into a stag to be torn to pieces by his own hounds. Thus also according to another representation on a coin (*pl.* 21, *fig.* 20, *a* and *b*), she appears in the act of shooting with an arrow the captive (very probably *Orion*, afterwards honored with the name of a constellation) whom she learned to esteem on account of his fondness for hunting and his intrepidity, but who fell a victim to her resentment the moment he dared to love her. Towards only one mortal, *Endymion*, a handsome shepherd, she was less vindictive and unfeeling. She first saw him sleeping in a forest on a mossy bed, while she was leading the moon up the sky. Enraptured at the spectacle, she found it impossible to refrain from checking the celestial chariot to impress a kiss upon his lips. In compliance with her prayer that he might always sleep and never become old, Zeus transferred him to Olympos, but subsequently sent him to the world of shades for rashly cherishing a tender regard for Hera. Among all who fell under the wrath of Artemis, however, none suffered so mournful a fate as the children of *Niobe*. Their mother, the wife of *Amphion* king of Thebes, had borne seven sons and seven daughters, and with a feeling of maternal pride exulted over Leto, and boasted of excelling her who had borne only two, Apollo and Artemis. Offended at this reproach Leto accused Niobe to her daughter Artemis, who at once vowed to avenge the affront offered to her mother. Soon after Niobe's fourteen children died, all slain by the arrows of Apollo and Artemis. This tragic scene is represented in bas-relief upon the side of a sarcophagus (*pl.* 21, *fig.* 6).

There are yet two other works of art connected with this transaction. In *pl.* 20, *fig.* 17, we see Niobe as she anxiously exerts herself to cover her youngest daughter with her veil, to protect her from the arrows of Artemis; while *fig.* 18 presents Amphion, the husband of Niobe, in a tunic, to which are added the mantle and Cretan buskins or boots. His whole attitude is expressive of the most frantic desolation at the death of his children.

Artemis also visited with her wrath the Greeks while they assembled in the harbor of Aulis, preparatory to their expedition against Troy. Their chief, *Agamemnon*, king of Argos, went into her grove, and in spite of the warnings of her priests, killed one of her white hinds. The enraged goddess invoked the aid of Poseidon so to restrain the winds as to hinder the

Grecian fleet from pursuing the voyage. The calm lasted several months, and the gods still refused to send a prosperous gale. In reply to their inquiries, the seer *Calchas* informed the Greeks, that as Agamemnon had offended them they would be appeased only by the sacrifice of his daughter *Iphigenia.* The guilty chief heard the decree with horror and a bleeding heart, yet he saw himself compelled to yield to stern necessity. The innocent maiden was decoyed into the camp under the pretext of a marriage with *Achilleus*, the handsomest of all the Greeks, and there borne as a sacrifice to the altar; but the sufferings of the guiltless victim softened the heart of offended Artemis, who enveloped the spot with a dense cloud, and removed Iphigenia to Tauris, where she afterwards became her priestess, leaving in her stead a hind on the altar, which was found when the cloud disappeared, and sacrificed instead of the maiden.

13. Particular Groups of the Superior Gods. Before leaving the Olympic Assembly, we propose to refer briefly to some representations of the groups of the gods, which, from a desire to keep the subjects separate, we have thus far left unnoticed.

Pl. 19, *fig.* 2, gives a characteristic group of *Zeus*, *Hermes*, and *Aphrodite.* Zeus sits in majesty upon his throne, the rays of divinity encircle his head, the left hand grasps the sceptre and the right the thunderbolts, while his sacred bird, the eagle, stands at his feet. He directs a commanding look at Hermes, who is preparing to depart on an embassy. On the left of the king of gods stands Aphrodite, joining eagerly in the conversation, while Eros, or Cupid, clings closely to her side. On the edge or rim of the picture appear the twelve signs of the zodiac.

Pl. 27, *fig.* 28, represents *Pallas Athene*, *Asclepios*, and *Hygeia.* The goddess is seated upon the throne, with a simple helmet upon her head, and a small ægis from which the Medusa's head is wholly excluded. She appears dressed in full vesture, and holds in her right hand the sceptre. At her left stands Asclepios, the god of medicine, holding a rod or wand around which is coiled a serpent. Hygeia, goddess of health and daughter of Asclepios, whose symbol is also the serpent, occupies a position on the right. The whole collection is obviously designed to represent Athene in her peculiar character and dignity as the preserver of health.

Another group, combining *Poseidon*, *Amphitrite*, and *Eros*, is given on a cameo (*pl.* 18, *fig.* 11); Poseidon, supporting himself on the trident, places the left foot on a rock. On both sides of him stand two horses sacred to him. In front a female form is reclining on the ground; it is probably Amphitrite, who seems to be sleeping. Behind him sits a child with uplifted hands. Above Poseidon's head a love, probably Eros himself, stands upon a pillar or altar; while to the left a manly form hovering in the air is offering a child to a female in a similar position on the right.

A very beautiful group of the busts of the twelve superior deities, representing them as deities of the planets, may be seen on a circular altar (*pl.* 19, *fig.* 1). Apollo (*a*) occupies the first place, as god of the sun, father of the year, and creator of the seasons. His head is encircled with a braided bandage. Next to him is Hera (*b*), whose hair is secured in a similar

manner. Then follow Poseidon (*c*), with his trident; Hephæstos (*d*), with the *pileus* or rounded cap; Hermes (*e*), with the caduceus near him; Demeter (*f*); Hestia (*g*); Artemis (*h*), easily recognised by her quiver; Ares (*i*), with his helmet; Aphrodite (*k*), with Eros resting on her shoulders; Zeus (*l*), with the thunderbolt; and Pallas Athene (*m*), with the helmet on her head and the lance near her, completes the circle.

Pl. 18, *fig.* 25, represents the assembly of the gods on Mount Olympos. Zeus is sitting upon his throne, the ideal of domestic kindness, yet by no means without the dignity belonging to him as king of the gods. On his left arm leans the sceptre, in his right he holds the goblet filled with nectar, and at his feet stands the ever sacred eagle looking up to him. *Ganymede* and *Hebe*, in the foreground to the right, perform the office of cup-bearers. A little behind Zeus, on his right, sits Hera, the queen of the gods, her dress and mien bespeaking the chaste, deeply thoughtful housewife; near her feet is her sacred bird the peacock. Aphrodite, the goddess of beauty, stands on the left of Zeus, holding by the hand her favorite Eros. Beyond those just mentioned we easily recognise Hermes, who at the command of Zeus is introducing Psyche to Olympos; Poseidon seated, with his trident, on a bank of clouds, and conversing with Hades, who, with a bifurcated sceptre, stands close by, and is indeed leaning over to the god of the ocean. In front of Poseidon sits Hephæstos, with his symbol, the lion, stretched at his side. Behind the queen of the gods stands Ares clothed in full armor; and the figure seen near him, with his head covered with a lion's skin, is probably *Heracles*, who has just been received to Olympos. On the left behind Zeus, and somewhat elevated, we observe Pallas Athene; close by her is Apollo touching the strings of his lyre, while behind both appears Artemis as Selene, with the crescent on her head. Several muses are accompanying Apollo on their instruments; two genii are strewing flowers upon Psyche, and the whole picture seems to represent the celebration of her admission to Olympos.

14. The Notions of the Greeks with regard to Olympos. With regard to the residence of the gods, the Greeks seem to have entertained conflicting ideas at different times. Several mountains bore the name of Olympos; but that lying in Thessalia was regarded by the ancient Greeks as the highest mountain in the world, and the central point of the whole earth. For this reason they supposed it to be the celestial mount, or mountain of the gods, upon which the deities dwelt. Near the summit they supposed there was an opening into the canopy of heaven, the abode of the gods, which was supported by pillars at the extremities of the earth. In addition to this opening it had two gates; the one to the east, through which the sun god Helios and Night with her train ascended from the ocean; the other opening to the west, through which they returned to their residences. At various elevations of the many-peaked Olympos, the individual gods dwelt in their palaces; but on the loftiest summit of all stood the court of the omnipotent Zeus. Thither all the rest repaired either on visits or to attend the banquets. From this position also the mighty god scanned the circle of the earth, sent rain and clouds, and hurled his thunderbolts. The twelve

superior gods constituted the council or divine senate of Elders on Olympos, but all the other deities composed the great assembly.

At a later period, as the conception of the universe and the gods became more enlarged, the Greeks transported the gods to the furthest sphere of the heavens, uniting them with the planetary world, and gave to this new divine abode the name of Olympos.

2. Gods of the Lower World.

After the Olympic gods, the deities of the world of shades constituted the next rank. Of these the most powerful and supreme was

1. Hades (*Aïdes*, *Aïdoneus*, or *Aïs*, also *Orcos* and *Dis*). He was the son of Cronos and Rhea, and at the partition of the universal government he obtained by lot his kingdom, where he reigned with an authority equal to that of Zeus in the upper world. At a later period the Greeks gave him the name of *Pluto*, to indicate his kingdom, the treasures, mines, and metals in the bowels of the earth. After his rescue by *Metis* from his father, who had devoured him, he was brought up in a dark cavern. In this way he came to prefer darkness to light. His exterior greatly resembles that of his brothers Zeus and Poseidon, the principal point of difference being apparent in the hair, which in Hades falls on the forehead, while in the brothers it is drawn back to the crown. This gives to his whole aspect the seriousness and gloom of a judge from whom justice but not mercy may be expected. In *pl.* 23, *fig.* 3, he is represented sitting upon a throne, dressed in a long flowing tunic, and holding in his left hand a sceptre. On his head stands a *modius* or measure, to signify that he will rule justly and impartially, and distribute rewards and punishments in exact accordance with merit. The terrible impression of his awful majesty is considerably augmented by the three-headed dog *Cerberos*, which stands at his feet with a snake round his body. The busts of Hades (*pl.* 23, *fig.* 1; *pl.* 22, *fig.* 17), which are also distinguished by the *modius*, disclose the same earnest solemnity. During the war with the Titans he gave valuable aid to his brother Zeus. Having obtained one of the double lances wrought by the Cyclopes expressly for that contest, he doubled the number usually slain by him, and thus rendered himself terrible to the usurpers. The fearful helmet which he wore, and which rendered its wearer invisible, made him a very formidable enemy. By its assistance he wrested the sickle from Cronos, which rendered him both invincible and irresistible in battle.

2. Persephone (Proserpine), daughter of Zeus and Demeter, was the wife of Hades, and as such queen of the lower world, where she lived four months of the year with Hades, assisting him in judging the dead, and often sending her messenger *Ate* to bid transgressing mortals appear before her tribunal. In the representations which exhibit her in this character (*pl.* 23, *fig.* 11) she bears a strong resemblance to Hera. The dress and diadem are the same; one hand holds the sceptre, and the other the sacrificial cup. The two serpents, however, on the diadem of Persephone clearly

distinguish her as queen of the world of shades from the milder queen of the sky. Indeed, her entire figure is wanting in that majestic and matronly quality so prominent in the statues of Hera. She was often represented as a *virgin*, especially on coins. Thus at *fig.* 12 *b* we see her bust with a collar, and a diadem used as a head-band, which marks her as *Libera.* The dolphins are intended to indicate the fertility of Sicily, whose inhabitants especially worshipped her, believing that Zeus had presented her this island as a marriage gift. The inscription on the coin shows that it is Syracusan. The *reverse* of this coin (*pl.* 22, *fig.* 18 *b*) exhibits an *Olympic* (*i. e.*, a victor in the Olympic games) riding in the *quadriga* (a car drawn by four horses abreast), and receiving a crown from *Nike*, the goddess of victory. Immediately below is a complete suit of armor, consisting of shield, coat of mail, helmet, and greaves.

The obverse of another coin, which, through the mistake of our designer, has been confounded with the first one mentioned (*pl.* 23, *fig.* 12 *a*), represents *Persephone* also as a virgin, with a wreath composed of ears, and the head-dress of her mother Demeter; while the reverse (*pl.* 22, *fig.* 18 *a*) shows a Nike or Victoria placing a trophy upon a field of battle. Among the ancients this was accomplished by hewing the trunk and limbs of a tree to something like a human shape, and then placing upon them the war equipments of a fallen enemy, the helmet, mail coat, tunic, shield, &c. Some have also supposed that *pl.* 24, *fig.* 4, was intended for Persephone as virgin, but as we have only coins representing this goddess in that character, the presumption is against such a conclusion, so that the figure probably refers to some other similar goddess. The coin (*pl.* 25, *fig.* 19 *a*) represents her repelling Zeus, who approaches her as a serpent.

So long as she assisted her husband in passing sentence upon the dead, Persephone equalled him in stern and sober gravity. Still, she was not wholly insensible to appeals prompted by love or compassion, and *Admetos* and *Orpheus* were indebted to her for the recovery of their wives *Alcestis* and *Eurydice* from the world of shades.

3. The Inferior Gods.

The inferior gods, whose nature is not easily defined, but who possessed some traits of divinity, composed the third order of deities. Considering the extensive sphere which he occupied, and the influence which he exerted, *Eros* held the highest position in this class.

1. Eros (Cupid, Amor, or Love) is not mentioned by Homer, but in the older theogonies Eros emerged together with *Gaia* (earth) from *Chaos*, and was the symbol of the vital and generative principle, also the element combining and assimilating contending forces in the primeval creation. Sappho makes him the offspring of heaven and earth.

In the later legends, however, the supernatural being known as *Eros*, the most youthful of all the gods, was the son of *Ares* and *Aphrodite*, and was recognised as the god of love. His chief occupation consisted in exciting

in the heart the passion of love; and such was his power, that not even the gods themselves could suppress the sentiment when once awakened. And thus Eros ruled in heaven, earth, and hell. He was usually represented as a beautiful, light-haired, rosy-cheeked boy, with wings, bow, arrows, and quiver; sometimes also bearing a torch, to indicate his character as illuminator of the soul. As vanquisher and ruler of the gods and men, he often pursued his sports, employing temporarily the attributes of other deities or heroes. Thus he appears (*pl.* 29, *fig.* 5) armed with the shield, helmet, and lance, or (*fig.* 6) investing himself in the equipments of Ares in token of his having subdued even the god of war. *Fig.* 3 shows him borne by Heracles, who is clothed in the lion's skin, and carries the characteristic club in the left hand; and in *fig.* 4 he is riding on a tamed lion, and playing on Apollo's lyre, a felicitous emblem of the united power of music and love. Slyness, desire, dissimulation, wantonness, caprice, and love of dominion constituted his prominent characteristics. His method of kindling the feeling of love was by sending an arrow into the heart of his victim. The point of the arrow was touched by his mother sometimes with honey, sometimes with gall; and Eros took a mischievous delight in inflicting wounds even upon the gods most distinguished for sobriety, seriousness, and dignity; in creating the tender feeling in hearts the most dissimilar; and exciting love when its reciprocation was improbable, or its gratification attainable only through violence. He did not even spare his mother. Accordingly Zeus, who from the moment of his birth discovered his tendencies to wily artifice, commanded his mother Aphrodite to destroy him; but she concealed him in forests, where he was nourished and brought up by wild beasts. Here he grew sufficiently strong to carve out for himself a bow from ash-wood, and arrows from the cypress; and he first employed his weapon upon the animals around him, with a view to the attainment of greater skill in hitting men and gods. When afterwards he was transferred to Olympos, he endeavored to ingratiate himself into the favor of all the gods. He succeeded with all except *Themis*, *Artemis*, and *Pallas Athene*. *Hephæstos* so loved the boy that he wrought for him a silver bow and golden arrows, which he thenceforward used.

Among the numerous stories of Eros, none have a better claim to notice than that of his connexion with *Psyche*. Psyche was the daughter of a king, and her beauty was such as to cause her to be mistaken for Aphrodite herself. Her two less favored sisters were married, but Psyche remained single, no suitor deeming himself worthy to be the husband of one so lovely. At length Eros saw and loved her, and resolved to make her his wife. The sorrowful father in the meantime consulted the oracle of Apollo, and received instructions that as his daughter had been selected for the bride of a winged dragon, he should lead her with a funeral procession to a mountain, and there leave her. The oracle was obeyed, and amid the tears of the people Psyche was left in a solitary spot. So soon however as all had retired, a *Zephyr* caught her up and bore her to the palace of the god of love. Here she was surrounded by every imaginable joy and comfort. Invisible hands fulfilled her wishes before they were clear even to herself.

Eros visited her only in the dark hours of night, and admonished her against any inquisitive attempts to know more of him, assuring her that such knowledge would change her happiness to the deepest misery. For a while her bliss in her new abode was complete, but she soon felt the need of society, and obtained from Eros permission for her sisters to visit her. So soon as they beheld the magnificence and splendor of the palace, they began to envy their happy and fortunate sister, and at once endeavored to destroy the happiness which they could not enjoy. Accordingly they persuaded Psyche to gratify her curiosity in regard to the nature and character of her lover, by providing a concealed lamp, and inspecting him during his slumbers. The next time he came she followed their advice. His transcendent beauty so agitated her, that in her excitement she let fall a drop of heated oil upon his shoulder. He instantly awoke, and after reproaching her severely for disregarding his admonition, he left her. She awaited his return long and in vain, and at length her distress and anxiety became so excessive that she cast herself into a river near by, hoping at once to put an end both to her life and anguish. But the waves did not permit her to sink; they wafted her gently to the shore, where she was discovered by *Pan*, and encouraged to appease her departed lover by repentance and unceasing effort to find him. After protracted and painful wanderings she finally arrived at the temple of Aphrodite. The latter, still jealous of her beauty, received her, but imposed upen her the heaviest trials, which, had not the invisible Eros assisted her, she could not possibly have performed. She is represented (*pl.* 29, *fig* 11) flying awed and terror-stricken from the persecutions of Aphrodite. The butterfly's wings on her back are her attributes, since Psyche signifies both butterfly and soul. At length the relentless Aphrodite sent her captive to the world of shades to obtain from Persephone a box of beauty. She procured it, and on her journey back her curiosity prompted her to open it, when a thick vapor issuing from it felled her to the ground. Eros now hastened to her relief, and touching her with an arrow restored her to animation. At length Aphrodite's wrath was appeased. Zeus, at the solicitation of Eros, granted to Psyche the gift of immortality, and the union of the lovers was celebrated with becoming magnificence on Mount Olympos. Their marriage procession is represented in *pl.* 29, *fig.* 9: Hymen is leading the bridal pair to the couch which a Love is preparing, whilst another holds over their heads a small basket of fruit.

2. Dionysos (Bacchus), the son of Zeus and Semele, was the god of wine, and in later mythology was numbered among the Olympians. While a child he discovered the art of improving the vine and expressing from the grape the soul-exhilarating wine. He also taught these arts to men, and strove to spread the culture of the vine over the habitable earth; and where the soil was unfavorable to its growth, he taught the art of preparing a palatable beverage from barley. His course through the different countries resembled a triumphal procession, men and women everywhere hailing him with shouts and acclamations. He rode upon a car drawn by panthers, tigers, lions, or lynxes; sometimes he was conveyed upon centaurs, and his retinue was usually composed of *Pans*, *Silenoses*, *Fauns*, *Centaurs*, *Cupids*, and

Mœnades, or *Bacchantes*, sporting, dancing, and rejoicing from the effects of wine. Everywhere he was received with delight, and all who honored him enjoyed his favor and beneficence. None of the gods received a more universal worship than Dionysos. The mythologies of India, Lybia, Assyria, and Egypt embraced a deity of this name, and that of ancient Greece recognised two, the elder of which was the son of Zeus and Persephone, the younger of Zeus and Semele. The myths relate that the jealous Hera, enraged at her husband's visits to Semele, persuaded the latter to request Zeus to approach her the next time in his true form as the god of thunder. His compliance, which she had insured by making him promise to grant any request she might make, proved her ruin; she could not endure the sight of Zeus in his majesty, and expired in the flames. Zeus desired, however, to preserve her unborn child, and as it wanted three months to maturity, he inclosed it in his thigh, whence in due time it was born (*pl.* 24, *fig.* 7), and received by Hermes, who, in order to protect the tender limbs of his charge, enveloped it in a *Nebris*, or sacred fawn-skin. Zeus commissioned Hermes to carry him to *Athamas* and *Ino*, in Thessaly, to be educated; but as the wrathful Hera persecuted both him and his foster parents, he was subsequently transferred to the mountains composing the range Nysa, where he was suckled by Nymphs and instructed by Silenos (*pl.* 23, *fig.* 19). One of the nymphs, *Leucothea*, nursed him tenderly; and in *pl.* 24, *fig.* 8, we see him resting on her arm, grasping the handle of a wine cup with one hand, and caressing his nurse with the other. Leucothea herself is dressed in the tunic without sleeves, and a mantle covers her shoulders and neck.

We have said that many deities bore the name of Dionysos (Bacchus); they all, however, gradually blended into one, and the various deeds of all came at length to be attributed to the youngest, namely the son of Zeus and Semele, whom the poets distinguished by the epithet the *Theban Dionysos*. In their representations the artists did not confine themselves to any uniform idea of his person, but permitted their fancy to follow the various conceptions indicated by the myths and traditions relating to this god. Some allusion has already been made to the statues of Dionysos the infant. In addition to these we sometimes see him represented as a youth, and to such images we shall apply the term *adolescent* or *Theban;* then the manly, bearded, or *Indian Dionysos;* and finally, we have the horned, or the ox, resembling Dionysos the son of Persephone.

The *Theban Dionysos* is characterized by a figure, countenance, long hair, and general expression, exhibiting the roundness, delicacy, and tenderness of a beautiful maiden, rather than the qualities of a vigorous youth. The face is a slightly prolonged oval, while the moderately full lips indicate the love of pleasure; the eyes are not particularly lustful nor yet far-seeing, but the expression seems rather feeble and languishing. A very customary symbol is the frontlet and a crown of ivy or vine leaves bound round his hair, which is long, flowing, and gathered in a knot or bunch on the back of his head, only a few locks on each side lying upon his shoulders. The head itself is slightly inclined. The structure of the

body corresponds to the cast of the face. It is neither heavily set nor yet slender; the shoulders have a tolerable breadth, and the breast and hips, like those of a young woman, are more fleshy than muscular. A gentle fulness or swelling harmoniously surrounds his limbs, and one might easily mistake his whole form for an Aphrodite under the guise of a lovely youth. These traits may be seen in the group (*pl.* 24, *fig.* 11) where Dionysos is leaning against the stump of a tree, around which are wound vine leaves. His left arm embraces the neck of his son *Faunus*, the fingers grasping a wine cup, while his right hand lies on his head. In *fig.* 12 he is resting on the stump, holding a broken *thyrsus* (a rod wrapped with ivy leaves); and in *fig.* 13 he reclines gracefully on a rock (probably on the summit of Mount Parnassos, where offerings were made to him), holding the wine goblet in his right hand.

The *Indian* or *bearded Dionysos* (*pl.* 24, *fig.* 15) is of a more dignified, commanding, and regal aspect. A wide tunic, gathered in numerous folds, reaches to his feet, and over it is thrown an ample and splendid mantle. His left hand grasps the *thyrsus*, his hair is confined by a bandage, his right hand holds a wine cup, and his whole countenance is expressive of repose, serenity, and mildness. Upon a coin from Naxos (*pl.* 25, *fig.* 6) he appears with shorter beard and hair, yet with the bandage decorated with vine leaves.

The representations of the *Horned Dionysos* somewhat resemble the figure just now described. Sometimes he appears with dishevelled hair, and the voluptuous expression of a beautiful Faun. Statues of this description are not now in existence, but there is a beautiful herma which we have copied (*pl.* 18, *fig.* 13). The hair falls, as with the Fauns, in disorder over the forehead; the horns are springing, not from the forehead, but from among the hair. The diadem encircles the head behind the horns, its broad fastenings falling down upon the shoulders. We find Dionysos in the form of a bull, yet with the beard and face of a man, only on coins where he is called *Dionysos Zagreus* (*pl.* 25, *fig.* 19 *b*; *pl.* 15, *fig.* 27 *b*).

Thus far we have considered the solitary representations of this deity; it remains to mention the groups with which he is connected. The first is shown on a large brass coin (*pl.* 28, *fig.* 5), where Dionysos and Apollo are travelling in a celestial chariot drawn by a panther and a goat. Dionysos supports his body on his left elbow, and holds with his left hand the thyrsus; Apollo plays on the lyre; and Cupid is riding on the goat. According to a different representation (*pl.* 26, *fig.* 12) he symbolizes the sun and god of the seasons, rides upon a panther, and pours wine into a drinking-horn held by a satyr who carries also a wine-skin; the winged genii of the four seasons (*Horæ*) are stationed around him. First on the extreme left stands *Winter*, who is carrying two geese and a cornucopia. Next appears *Spring* crowned with flowers, holding in one hand the mystical box, in the other the sacred tie or bandage. The third is *Summer*, who carries a sickle and ears of corn; and finally *Autumn* is seen with a hare and cornucopia. Fauns, Satyrs, and boy-fauns, the usual attendants of Dionysos, playing with panthers and goats, occupy the back-ground. In *pl.* 25,

fig. 4, Dionysos is reclining in an indolent attitude upon a trotting ass. He is holding his usual attributes, the thyrsus and drinking horn; before him marches a satyr playing on a double flute; and in front and behind the group are seen a sacrificial cake and a sacred sash. In *fig.* 5, he is represented riding with a radiant crown on a panther or tiger; a Mænad with two torches leads the way, and a satyr with a huge wine goblet follows after.

A celebrated myth which furnished an admirable subject for artists, was the love of Dionysos for *Ariadne*, of which the following are the principal incidents. Ariadne was the daughter of *Minos II.*, king of Crete, and *Pasiphoë*, who had also borne to her husband the *Minotaur*, a monster with a human body and the head of a bull, endowed with immense strength, and whose hunger could only be appeased with human victims. At the time of his birth there resided at the court of Minos an Athenian artist, *Dædalos*, who had been condemned to death in Athens for the murder of a rival, but who made his escape, and was kindly received and protected by the king of Crete. During his exile he built the celebrated *Labyrinth* in which the Minotaur was confined and fed on human flesh. His common victims were criminals or captives taken in war; but when Minos had conquered Attica, enraged at the loss of his eldest son *Androgeos*, who was murdered at the instigation of *Ægeus*, king of Athens, he imposed upon the country an annual tribute of seven Athenian youths and virgins, to be given to the Minotaur. When this revolting tribute was to be paid for the fourth time, *Theseus*, the king's son, voluntarily joined the number of the victims, with the intention of conquering the monster or of perishing with his companions. His youth and beauty affected the heart of Ariadne, who presented him with a ball of thread by which to guide himself into the labyrinth, and afterwards find his way out. He soon found the Minotaur and slew him (*pl.* 30, *fig.* 17), and then carried off and married his protectress. Arriving at the island of Naxos, he yielded to the persuasions of his companions, proved faithless to Ariadne, and set sail secretly without her. Sad and deserted, she endeavored to terminate her existence in the waves; but *Morpheus*, god of dreams, spread over her eyelids a soft balmy slumber. At length Dionysos discovered her on the rocky shore (*pl.* 24, *fig.* 14). Captivated by her extraordinary beauty, he declared his love, and after satisfying her that he was a god and was sincere in his proposal, she consented to be his wife. *Fig.* 5 represents a solemn procession of the two lovers; though according to some writers the central couple are Dionysos and Demeter. Both are standing on the chariot. The mantle of Dionysos has fallen to his hips, while the *nebris* or sacred fawn-skin covers his breast. He carries in the right hand a double-handled wine vessel, in the left the *thyrsus*. Ariadne, clothed in a wide tunic, rests her right arm upon her husband's shoulders, while her left hand carries poppies and ears of wheat. Both are crowned with wreaths of ivy. A joyous sporting Cupid stands on the right of Dionysos. The car is drawn by two centaurs, one of which holds a thyrsus and drinking horn, the other a goblet and blazing torch. They are assisted by two female centaurs, one blowing a double flute, the other beating the tambourine. The chariot itself is decorated with serpents' eggs and tongues, and the centre bears

a head with flowers and ivy. At the feet of the centaurs on the right is a *cista mystica* (sacred box) with the Dionysian serpent, on the other side an overturned wine vessel. In addition to these groups we have a beautiful head of Ariadne crowned with ivy (*pl.* 29, *fig.* 1); and a highly finished bust (*pl.* 18, *fig.* 15), with a crown of vine leaves and clusters, while bunches of grapes constitute the ear pendents, and mingle with the falling hair.

Among the sculptures having reference to Dionysos is a fine bas-relief representing a procession of Bacchanalian genii (*pl.* 18, *fig.* 12). The first figure on the left of the observer carries a little tambourine suspended by a cord from his left hand, his right holds an inverted torch, while his left foot stands on a shepherd's crook. The second carries a cithara and a plectrum (a small rod of ivory with which ancient musicians played the cithara), and a reed flute lies at his feet. In the centre appears a drunken, staggering genius, supported by two of his companions, at whose feet lie cymbals and a panther. The sixth carries over his shoulder a wine-skin and in his right hand a thyrsus; the seventh has a shepherd's crook and a lantern; the eighth, at whose feet lies a mask, is striking a cymbal; while the last is playing on a single flute. All are winged and clothed with mantles which cover only the back and fasten on the shoulders; and several have the hair neatly gathered up and knotted in front.

3. Asclepios (Æsculapius), the son of *Apollo* and *Coronis*, whom Apollo had put to death on account of infidelity, was nourished for a while by goats. He was subsequently consigned to the wise centaur *Cheiron*, who instructed him in hunting and the healing art. Being of a quick and lively genius, he soon became so proficient in medical science as not only to overcome the most inveterate diseases, but also to restore to life the dead by the blood of *Medusa* obtained for him by Athene. He eclipsed the celebrity of his instructor, and drew upon himself the wrath of Hades, who could no longer bring mortals under his gloomy reign; and even Zeus felt jealous of his power, fearing that, by the removal of the terrors inspired by the prospect of a future life, men would consider themselves released from their obligations to the gods. Accordingly the mighty thunderer hurled at him one of his bolts, which consigned him to the world of shades. By the intervention of his father Apollo, however, he was transferred to Olympos. As the god of healing, he received profound honors not only after his reception to Olympos, but also during his stay on the earth. He is represented (*pl.* 28, *fig.* 24) as a bearded man, in a dignified attitude, and with a countenance expressive of wisdom, benevolence, and great experience. His customary dress was a mantle in numerous folds, and his constant attribute a knobbed staff around which was coiled a snake. His head was covered by a low cap or adorned with the laurel crown. The animals sacred to him were the goat for having suckled him and the dog for watching him in his infancy, the cock, the owl, and the raven.

A different, and probably more ancient representation of Asclepios (*pl.* 15, *fig.* 23) shows him as a beardless youth, clothed in a long sweeping tunic and mantle, wearing a high pointed cap, and characterized only by the serpent in his hand.

His daughter *Hygeia* (*pl.* 24, *fig.* 19) was the goddess of health, and was represented as a plain virgin feeding a serpent out of a cup. His son *Telesphorus* (*fig.* 21) was the protector of convalescents. He appears extremely youthful, is dressed in a wide mantle, and his head covered with a cowl which is a continuation of the mantle, the whole figure indicating the precaution observed by convalescents to avoid a relapse. In *pl.* 27, *fig.* 29, we have copied a beautiful group, in which Asclepios is represented sitting on a throne; near him stands Hygeia, feeding the serpent from the cup; while on each side sits a youthful form, one Telesphorus and the other probably another of his sons.

4. Subordinate or Ministering Deities.

1. Hebe was the daughter of Hera and goddess of youth. In Olympos she discharged the office of cup-bearer. She was represented as a lovely young maiden. Sometimes she appears leaning against an altar, holding in one hand a pitcher, in the other a cup, from which the eagle of Zeus is drinking (*pl.* 17, *fig.* 25). She is also represented (*pl.* 21, *fig.* 4) in the act of approaching with her pitcher, holding it aloft as if pouring out its contents. On a gem (*pl.* 22, *fig.* 11) she is caressing the eagle of the king of gods, which stands with one foot on a rock, the other on a globe of empire. The wings attached to her indicate her agility and swiftness.

Her office of cup-bearer was transferred to *Ganymede* after her marriage to Heracles, or according to another myth, when in handing a cup to Zeus her foot had slipped, and she had fallen and spilt the nectar. Ganymede was a very handsome shepherd, and was seized by Zeus's eagle, or by Zeus himself in the form of an eagle, and carried to Olympos, where, before entering upon his office, Aphrodite instructed him in his duties. In accordance with these incidents he was usually represented as a beautiful youth (*pl.* 17, *fig.* 24), his head covered with a Phrygian cap, a short cloak thrown over his shoulders, holding in the left hand a shepherd's staff, and in the right a cup from which he feeds the bird of Zeus with ambrosia.

2. Iris, messenger of the gods, and particularly of Hera (*pl.* 21, *fig.* 5), is a winged goddess, wearing a double cloak over a long tunic; her left hand holds a herald's staff and her right a helmet, which, in the picture whence our figure is copied, she is in the act of placing on a young warrior.

3. Nemesis was one of the goddesses of justice, who so guided events that every deed met with reward or punishment according to its merits. While she encouraged genuine worth, she visited injustice with unrelenting severity. She is usually represented (*pl.* 23, *fig.* 5 *a*) standing, and dressed in a tunic. With her right hand she holds the garment which covers her breast a little distance from her; and she looks towards her bosom as if scrutinizing her inmost emotions. This attitude is intended to indicate the manner and measure by which she judges of human character and deserts. Her left hand holds an ash twig; a wheel stands at her feet, and she usually appears with wings. As *Nemesis Panthea* we see her (*fig.* 5) endowed

with the wings of victory, the wheel of fortune by her side, and herself holding the serpent and cup of Hygeia, to signify her dominion over riches, war, and health. A totally different representation (*pl.* 16, *fig.* 2) shows her with a diadem, short upper and lower vestments, and with eagles' talons, her forefingers pointed against each other.

4. The Parcæ or Fates were three in number, Clotho, Lachesis, and Atropos. Their office was to spin the destinies of men.

5. The Eumenides, Erinnyes, or Furiæ, three in number, Alecto, Megæra, and Tisiphone, born from the blood flowing from the wounds inflicted by Uranos on Cronos, were goddesses of revenge, especially of murder, and was ornamented by eight statues, viz. those of the principal winds now named, and four at the points between them.

5. Aerial Gods or Winds.

At an early period the four principal winds were converted into mythical personages. We notice briefly:

1. Apeliotes, or the East Wind (*pl.* 22, *fig.* 12). He brought mild and refreshing rains, and fostered the growth of vegetables, wherefore he appears with fruit and a honey-comb in the folds of his mantle.

2. Notos, or the South Wind (*fig.* 13). He was also god of rain, and is accordingly represented with an inverted vessel.

3. Zephyros, or the West Wind (*fig.* 14), signified warmth in summer; he is represented as the promoter of vegetation in the spring, with his mantle filled with flowers.

4. Boreas, or the North Wind (*fig.* 15), is represented bearded and carrying a sea-shell, expressive of the roaring north wind. He seized and violently bore off to his cave *Oreithyia*, the daughter of *Erechtheus* (*fig.* 16), who did not, however, reciprocate his love.

The winds were subsequently increased, and an octagonal tower at Athens following the steps of a murderer by day and night, embittering every moment of his life, until he had expiated his crime.

6. Gods of the Water.

1. Nereus, son of *Pontos* and *Gaia*, ruled over the Ægean Sea. By his prophetic power, which never proved fallacious, he rendered important assistance to both gods and men. He was represented as a bearded old man (*pl.* 21, *fig.* 7), whose brow, chin, and breast were covered with a species of angular leaves taken from sea plants. Cows' horns spring from the crown of his head, two dolphins glide through his slimy beard, and vine leaves and clusters of grapes adorn his hair. The horns and dolphins properly characterize him as a sea god; the grapes and vine leaves refer especially to the celebrated vineyards on the coast of the Ægean.

2. The Nereids. These sea-goddesses were daughters of Nereus, and

were fifty in number. They are variously represented: sometimes riding on hippocamps (*pl.* 21, *fig.* 9), again sporting in the water, and surrounded by dolphins, cupids, and genii (*pl.* 22, *fig.* 2). They generally composed the retinue of *Amphitrite*, wife of *Poseidon*, who together with *Thetis*, the wife of *Peleus*, enjoyed a distinguished celebrity.

Thetis had been courted by Zeus and Poseidon, but *Themis* having declared that the child of Thetis would be greater than his sire, the gods withdrew. Peleus then urged his suit, but she opposed his entreaties until he obtained from *Cheiron* the power of changing himself into a fish, and appearing to her in this form. The wedding was celebrated on Mount Pelion, in the presence of all the gods except Discordia. In *fig.* 10, Thetis is represented bringing to her son *Achilles* the shield wrought by Hephaistos.

3. Glaucos, probably son of Poseidon, lived on the Black Sea. By means of a mysterious plant which he found and tasted, he was changed from a poor sailor of Bœotia into a sea god. He often assisted Nereus and warned the sailors of approaching dangers. His body, which above resembled the human form, terminated in two fishy tails. He is represented (*fig.* 3) with a crown of sea-weeds, blowing on a shell, and carrying a rudder on his shoulder.

4. Triton was a son of Poseidon and Amphitrite, and exercised his government over the Lybian Gulf, so notorious for its terrors. He was represented, like the innumerable Tritons who were his descendants, or perhaps only artistic multiplications of himself, as terminating in the double fish-tail with falcated fins; sometimes also he appeared with horses' feet. On a gem (*pl.* 19, *fig.* 12) we see a Triton and a Nereid. The Nereid is holding a young Triton on her arm and leading one with her right hand; a cupid, the constant attendant of sea deities, together with a dolphin, accompanies them. *Pl.* 23, *fig.* 22, exhibits a scaly Triton (taken from a fragment of a bas-relief), whose extremities are like those of a man. He is holding a sea monster and near him is the mutilated form of a woman, probably a Nereid. *Fig.* 21 gives us a view of a Triton's head, with a thick beard dripping wet and the head covered with a fish skin, apparently connected with a fish basket.

5. Palæmon, though, properly speaking, a sea hero more than a sea god, must be mentioned here, as he is identified by many with *Nerites* the son of *Nereus* and brother of the *Nereids*. His original name was *Melicertes*. and he was the son of *Athamas* and *Ino*. The latter, suspected by Athamas of having caused the death of his other children, was pursued by the enraged father, and finally threw herself with Melicertes in her arms into the sea. The child was saved by Poseidon, who sent a dolphin to convey him to the shore, where he was received by Sisyphos, who educated him. Afterwards Poseidon made him a sea hero, and he is represented as a handsome youth riding a sea-ram and flourishing a whip over his head (*pl.* 21, *fig.* 8). His preservation is recorded on two coins (*pl.* 22, *fig.* 9, and *pl.* 28, *fig.* 25), on which he is represented lying on the back of a dolphin; the tree behind him is intended to mark the spot where he was landed and received by Sisyphos, who appears in the last named figure

with the insignia of a victor in the Isthmian games, which he subsequently instituted in honor of his heroic pupil.

6. Other Water Deities. Without enlarging on all the specific classes of mythical personages supposed to occupy the waters, we enumerate briefly the beings which dwell in the fountains, rivers, lakes, and rivulets.

The *gods of the larger streams* were usually represented as bearded men (*pl.* 21, *fig.* 14). They appeared naked or nearly so, reclining in an easy position, the elbow resting on an urn from which water flowed freely, and with a crown of river grass or reeds, sometimes also with bulls' horns. The brooks and rivulets were presided over by beings more like boys or beardless youths.

The *goddesses of lakes and springs* were represented as graceful maidens, and bore the generic name of *nymphs*. Of these the most celebrated were the *Naiades*, one of which we see (*fig.* 14) in company with a river god; and another (*pl.* 19, *fig.* 9), carrying two water vessels. They were daughters of river gods and *Potamides* or river goddesses, and carried water for their parents. They showed themselves very partial to young girls and removed the freckles from all who bathed in their streams; but they were dangerous to young men, whom they dragged down to their abodes when they came near their watery domain. Thus *Hylas*, the friend and companion of Heracles (*pl.* 22, *fig.* 1), while attempting to take water from a spring near the city of Chios, was seized by these nymphs, who carried him down to their palace and smothered him with their fond embraces.

Hermaphrodites, a son of Hermes and Aphrodite (*pl.* 28, *fig.* 22), was once bathing in a fountain, when the naiad *Salmacis*, who loved him fondly, caught him in her arms and implored the gods that their bodies might never be separated. Hence Hermaphrodites arose out of the water half man and half woman. His myth refers obviously, both in Greek and Indian mythology, to the generative principle of the universe, vested in no single being but in the complete union of two.

The sea monsters, of which there were a great number, are most familiar in the form of the *Hippocamps*, horses with dolphins' tails (*pl.* 21, *fig.* 13). They were chiefly serviceable in drawing the cars of sea gods and in carrying Cupids (*pl.* 22, *fig.* 8).

7. Gods of the Mountains, Forests, and Fields.

A very large number of deities presided over the mountains, forests, and fertile plains, to guard them against the intrusion of man, or to assist him in making them tributary to his wants. The following are the most important of these deities:

1. Pan, the god of shepherds, fields, and hunting, was also the protector of bees and the giver of success in fishing. He was benevolent and friendly, and ever ready to shower his blessings upon man. Disposed to cheerfulness and gaiety, he often chased away the hours by singing and dancing on the verdant plains with the nymphs. His form was singular. His face resembled

that of a goat, small horns projected from his forehead, and he had a curved nose, long beard, goat's feet and tail.

With so few prepossessing qualities, his amorous exploits were not successful. He loved the Naiad *Syrinx*, but she fled from him, and when about to grasp her, the gods changed her into a reed. Presently the winds murmured gently through the reeds, and the sweet tones sounded like the echo of his lamentations for the loss of the loved one. He therefore cut from among the reeds several pieces of different lengths, which he tied together, and which produced enchanting music when the wind blew into them. In this way he discovered the seven-tubed *Syrinx* or pastoral pipe, upon which he subsequently became a proficient player. He instructed Olympos, the pupil of the unfortunate Marsyas, in the art of playing on this pipe (*pl.* 24, *fig.* 16). His principal attributes were the crooked shepherd's staff and the Syrinx. On a coin (*pl.* 25, *fig.* 3) he is represented sitting on a rock, holding the staff, while the Syrinx lies at his feet. The letters ΟΛΥΜ signify coin of the Olympians, and AR Arcadia, the district in which he was particularly honored.

Pan finally succeeded in obtaining for a wife the nymph *Æga*, and became the progenitor of a long line of descendants called *Panisks* or *Panines*, who were formed like himself.

Shortly after Pan's birth, when Hermes showed him to the gods wrapped in hare-skins, Dionysos became very fond of him. Afterwards, when Dionysos made his expedition to India, Pan accompanied him, and saved him by his shrewdness from falling into captivity. Dionysos and his flock of companions were completely inclosed by a large Indian army, who were hostilely disposed towards him, and might at every moment be expected to attack him. Pan advised Dionysos to set up a terrific howl, himself accompanying it with the discordant sounds of a horn; the Indians who, by the noise, supposed Dionysos attended by an overwhelming force, fled in terror, and permitted the enemy to escape. Ever since then a fright so intense as to deprive one of his self-possession is called a *panic*, and has become the subject of artistical representation (*pl.* 24, *fig.* 17 *a b*). The picture from which these figures are taken exhibits two heads of Pan admirably characterized (of which we have only copied one, *fig.* 17 *a*), and between them the head of an old man (*fig.* 17 *b*), whose bristling hair, gaping mouth, and staring eyes clearly denote him as suffering under the extreme of terror.

12. Silenos was usually grouped with Pan not so much on account of his exterior as from his mythological relations to Dionysos. He was tutor and counsellor of the latter, and at a later period not only his constant companion, but also the leader of the whole Dionysan chorus, and was classed with the field and mountain gods. The artists represented him as an old man with a flat nose, bald head, thin beard, the body of medium size, the flesh bloated and spongy, the breast hairy, the head drooping, the eyes small and sleepy, so that his whole figure realizes the conception of a little jovial old toper, and blends the opposites of jest and earnest, sublimity and meanness. It is contrast personified, yet so that the irony appears its

natural expression. In *pl.* 25, *fig.* 10, he appears leaning against a stump to which his cymbals are hung, pressing a bunch of grapes into a goblet, and his head crowned with ivy: on the coin (*fig.* 11) he is seated on the ground near a vine, his right hand holding a drinking cup. The inscription ΝΑΞΙΩΝ signifies coin of the Naxians. On another coin (*fig.* 12 *a* and *b*) he is riding backwards on an ass, holding a wine cup. The reverse shows a *diota* (double-handled vessel), with the inscription ΜΕΝΔΑΙΗ, a coin of Mende, a city of Macedonia.

As Pan had numerous Panisks, so the progeny of Silenos was extensive. They differed from their father in having pointed ears, and a tail on the back. One class among them (*pl.* 28, *fig.* 13) may be designated as genuine tipplers. They are of large, well-set frame, reclining comfortably upon deer-skins spread beneath them. A large wine-skin serves them for a pillow, and near them lies a drinking vessel. Their capacious bellies, flat and broad faces, short stumpy noses, pouting lips, and vinous joviality embody the perfect ideal of animal enjoyment. Another class of Silenoi is better shaped (*pl.* 24, *fig.* 18). This class is of vigorous, slender form, and by agility and swiftness especially fitted for dancing and sporting. The figure here given stands quiet and thoughtful, the elbow resting on a skin spread over a stump, and the right hand holding a thyrsus.

3. Priapos was the misshapen son of Dionysos (*pl.* 25, *fig.* 13) and a rural god in high repute at Lampsacus. Hebe has adorned his hair with vines and fruits; his right hand usually holds a scythe or pruning knife, and his cloak is filled with the fruits of the season.

4. The Satyrs bear a strong resemblance to the Silenoi, and were always represented as youthful. They had pointed ears and goats' tails, frequented the fields and mountains, and joined in the company and sports of Dionysos. We see a Satyr (*pl.* 25, *fig.* 2) in the act of presenting a sacrifice, and for that reason carrying a torch and fruits. Near by is the tiger sacred to Dionysos. The figure behind him is one of the *Bacchantes* (priestesses of Dionysos) playing on a double flute or pipe. Like the *Mænades* (*pl.* 21, *fig.* 21), they belonged to the land nymphs, and composed part of the train of Dionysos.

Besides the Bacchantes and Mænades, who were especially connected with Dionysos, the Grecian mythology recognised numerous mountain and forest nymphs, usually forming part of the train of Artemis. *Pl.* 20, *fig.* 16, represents such a nymph leading two hounds and carrying a horn, and another with the quiver on her back guiding a pair of bridled stags.

8. Goddesses of Time.

The Horæ, or Hours, were honored not only as goddesses of time, but also of order, beauty, and loveliness, and as goddesses of the seasons. They were daughters of *Zeus* and *Themis*, and were named *Dike* (Justice), *Eunomia* (Order), and *Eirene* (Peace). In time their number was increased to four, and still later to eleven, though four was the most common.

It was their business to promote the growth of vegetables, to gladden men and gods with the fruits of the year, and to guard the gates of Olympos, in front of which they collected or dispelled the fleecy clouds. They were also charged with the education of Hera and Aphrodite, whose companions they remained. On the front of a tomb erected to the Nasoes they are represented in the form of beautiful maidens, and as presiding over the Seasons, each one accompanied, however, by a male figure (*pl.* 29, *fig.* 13). The companions of Spring, Summer, and Autumn are handsome youths, one of whom carries a goat, the others fruits; but Winter is accompanied by an aged man with a long beard, and a tunic reaching to his ankles. His head is warmly clad, and he carries a stalk of corn and a goose. The attributes which distinguish the Horæ or Seasons were all taken from the productions of the year.

9. The Charites, or Graces.

The Charites (Graces) were at first the same with the Horæ, but at a later period were supposed to be their sisters. They were daughters of Zeus and Eurynome, or, according to some authors, of Aphrodite. They bestowed every grace, beauty, and charm of manners upon their favorites. While they remained the sisters of the Horæ, they dispensed their charms principally on the seasons and inanimate nature. As nymphs, however, they bestowed their graces upon the higher goddesses, Hera, Artemis, and Aphrodite, whose beauty alone had been an imperfect qualification in the absence of amiability and elegance. Their functions subsequently passed over to intellectual beauty, and entered into the arts and sciences and all forms of human cultivation.

In early times different opinions prevailed with regard to their names and number; but later three were especially recognised, *Euphrosyne* (Joy), *Aglaia* (Splendor), and *Thalia* (The Blooming). They were represented as young virgins, at first dressed, afterwards naked, and nearly always in a group, their arms entwined, their hands holding fruits, flowers, &c., and their heads gracefully inclined in different directions. On a circular glass plate (*pl.* 29, *fig.* 12), which seems to have formed the bottom of a goblet, we see them decorated with bracelets and anklets. Two of them hold a fillet or bandage, and near each stands a flower. The accompanying names vary from those we have given, though the half Greek and half Latin inscriptions may seem to confirm the above conjecture: *Piete* (drink ye), *Zesete* (enjoy life), *multis annis vivatis* (may you live many years). A group much resembling this (*pl.* 28, *fig.* 20) exhibits the Graces with flowers in their hands. By some writers it is affirmed that at a later period *Peitho* (Persuasion) was added to the Graces; and in *fig.* 19 she appears with them, the whole group being girded with the zone of beauty. Peitho was taken into the service of Aphrodite, and received the office of opening the mouths of bashful lovers and inspiring them with eloquent language in which to express their feelings and attachment.

10. The Muses.

The Muses, whose number and origin were at first variously stated, were subsequently fixed at nine, and regarded as the daughters of *Mnemosyne* (*pl.* 26, *fig.* 8), the goddess of Memory. The latter was represented in a thoughtful attitude, her arms enveloped in an ample garment. She taught mankind the art of language, and while Zeus dwelt at *Pieria* as a shepherd, and hiding from the rage of his father Cronos, Mnemosyne married him, and bore to him the nine Muses. The rustics at first considered them nymphs of the inspiring fountains, and honored them as the preservers of budding plants. Afterwards they were associated with Apollo, who acted as their leader, and were regarded as the goddesses of art and science, since these could not prosper without divine inspiration. Each one superintended some branch of knowledge, power, or art. We characterize their names and departments more particularly.

1. Calliope (gifted with a beautiful voice), the muse of epic poetry, proclaimed the fame of heroes by means of heroic verse. She holds in her hand the wax tablet and style (*pl.* 26, *fig.* 1 *a*), or a scroll of papyrus (*fig.* 2), and wears a laurel crown.

2. Clio (the proclaimer) was the muse of history, and recorded the transactions of the past. In this character she also is represented with a scroll in her hand, and sometimes resting her elbows on a pillar (*fig.* 1 *b*; *fig.* 3). Her head is crowned with ivy.

3. Erato (the lovely), the muse of amorous poetry, and of soft, touching music. She usually appears with roses and myrtle in her hair, and holding the lyre in her left hand and the plectrum in the right (*fig.* 1 *c*), or playing on the lyre (*pl.* 19, *fig.* 5).

4. Melpomene (the songstress), the muse of tragedy (*pl.* 26, *fig.* 1 *d*), is represented with the club of Hercules in the right hand, and in the left the tragic or heroic mask. She usually wears buskins or shoes with high cork soles.

5. Euterpe (the charming), the muse of music, as a symbol of her office usually appears with a double flute (*fig.* 1 *e*), but is also represented (*fig.* 5) sitting upon a rock and holding a single flute.

6. Thalia (the blooming), the muse of comedy, was represented with a comic mask and shepherd's crook (*fig.* 1 *f*; *fig.* 7).

7. Terpsichore (leader of the dance) was the muse of dancing, and is represented with a seven stringed lyre and the plectrum (*fig.* 1 *g*).

8. Urania (the heavenly) was the muse of astronomy and the sciences therewith connected, particularly the knowledge of divine subjects. A globe and measuring scale are her common attributes (*fig.* 1 *h*). She is also represented in a sitting position, her left arm resting on a sphere, the left hand holding a pair of compasses, and her gaze directed towards the sky (*fig.* 6 *a*), or with the measuring rule pointing to the globe in her hand, and the eye uplifted (*fig.* 6 *b*).

9. Polyhymnia (the much singing) favored eloquence, vocal music, and

mimicry. She appears in a meditative mood, composing and rehearsing hymns of the gods (*fig* 1 *i*); she also symbolized the acquisition and retention of knowledge, and accordingly she stands (*fig.* 4) dressed in full vestments, and wearing on her head a wreath of corn-bind. She had no special attributes, and both in symbolical import and representation is very similar to her mother, Mnemosyne.

The Muses, whose special office was the instruction of mankind in the arts and sciences, had their common residence on Mount Parnassos. There they are represented dancing to the music of Apollo's lyre (*pl.* 25, *fig* 21). To their right stands Hermes with the winged horse *Pegasus*, and the caduceus. On the summit of the mountain appear Ares and Aphrodite in the character of tender lovers. Near by is seen the mischievous Eros, striving to the utmost, if we may judge by his position and gestures, to apprise Hephæstos, the husband of Aphrodite, of her new attachment; and Hephæstos is obviously preparing for the loving pair an unwelcome surprise.

11. Nocturnal Deities.

1. Nux was goddess of night, darkness, and repose; hence her supremacy over gods and men. She was the last child born in *Tartaros*, and probably an evolution from chaos. Regarding Day as her greatest foe, she separated from him. When Day retired to rest, she ascended the sky, but returned to *Orcos* so soon as he again prepared to lead the hours of light.

She is often represented dressed in deep black and riding on a chariot; sometimes (*pl.* 17, *fig.* 1) without the chariot, but with a radiant head, starry veil, and an inverted torch; and again with outspread wings, soaring between the two stars of the Dioscuri (*pl.* 20, *fig.* 2). By her marriage with *Erebos* (subterranean night, the kingdom of death) she bore several children, all of whom were reckoned among the nocturnal deities. The principal ones were *Hypnos*, *Thanatos*, and the *Dreams*.

2. Hypnos (Sleep) conquered both gods and men, though he possessed the mild disposition of his mother, and sent tranquillity and repose to the wretched. During the Trojan war he provoked the ire of Zeus. The latter had especially prohibited all the gods from taking any part in the contest against the Trojans. Hera, however, who hated them on account of Paris who had given the prize of beauty to Aphrodite, induced Poseidon to fight against them; and in order to draw off the attention of Zeus from Troy, she bribed Hypnos by the promise of the youngest of the Graces as his wife, to put him to sleep. The trick succeeded, and Poseidon, landing on the Ilian coast, inflicted a terrible slaughter. Zeus was awakened by the din of battle, and was so enraged at Hypnos that he would have hurled him into the sea, if his mother Nux, whom even the king of gods did not like to grieve, had not appeased him.

Among the representations of Hypnos we must carefully distinguish between *material sleep* and the *genius of sleep*. The artists usually conceived the former as twin brother of death, a boy with closed eyes lying in the bosom

of his foster-mother *Night;* sometimes also (*pl.* 23, *fig.* 9) as an old man with closed eyes leaning on a staff, with loose disordered hair and beard, a tunic extending below the knees, and over this another garment with sleeves and fastened below the breast, and with strong wings on his shoulder and smaller ones on his head. The *genius of sleep*, on the contrary, is usually represented as a winged boy with an inverted torch (*fig.* 6), or as a young man (*fig.* 8) standing with reclining head and closed eyes, the left arm leaning on a stump, and the right hand holding the inverted torch. We often see him also in the form of a boy lying on a skin or the bare earth, with poppies, a lizard or a rabbit near him. According to the old legends, the lizard acted as the friend of man, and awoke the sleepers at the approach of a dangerous insect. The rabbit was no doubt a symbol of that retirement which the weary so much seek when desiring undisturbed repose.

3. Thanatos (Death), twin brother to Sleep, was god of material death. In representing him the artists endeavored to soften down the terrors of the popular picture of the death of matter, and made the form to correspond very nearly or entirely with that of Sleep. *Pl.* 23, *fig.* 7, presents us with a statue found on a sepulchral altar in the palace of Albani at Rome, with the inscription *Somnus* (sleep). From the situation of the altar, however, it may be inferred that material death, or probably the genius of death, was intended and expressed by the milder and less repulsive figure of sleep. Far more terrible is the representation of the genius of death (*pl.* 16, *fig.* 4), whose appalling black color, rapid step, expanded wings, dishevelled hair, and death-dealing weapon, all point to his errand, the destruction of life.

4. The Dreams were also the children of Night, and three of them appear to have been chiefly recognised. We have copied a group supposed to represent them (*pl.* 23, *fig.* 17) from a sepulchral lamp. A female form reposes gracefully on a lion's skin, herself partly covered, and near her in a pleasant easy position lie three winged children or genii sleeping. The largest of the group appears to be Night, the smaller figures Dreams; and the club, tree, bow and arrows, seem to confirm this interpretation.

A hideous exhibition of the Dreams is given in *pl.* 23, *fig.* 14. *Orestes*, whose youthful friendship for *Pylades* has become proverbial, had taken bloody revenge on his own mother in retaliation for her having connived at the assassination of his father *Agamemnon* upon his return from the siege of Troy. For the commission of this crime the *Eumenides* assailed him, and pursued him with their bloody serpent-whips night and day. Their appalling figures harassed him in his dreams, while his mother appeared at his side with the bloody dagger in her breast. He was at last permitted to propitiate them, and occupy the throne of his father in peace. This myth obviously connects the Dreams with the human conscience, which is symbolized by the Eumenides.

12. The Heroes.

The Heroes were sons of the gods by mortal mothers. They shared

some of the qualities of the gods, but were subject to the great law of mortality, with this difference from common mortals, that they were at once received into the society of the gods at the close of their earthly life. Like the gods they had sacrifices made to them, attended however by fewer solemnities; but, with very few exceptions, they had no special temples or priests dedicated to them. The following heroes are the most prominent, and their deeds have been sung by poets of all ages.

1. Prometheus (the Discreet, the Thoughtful) was the son of *Japetos* and *Clymene*, and belonged therefore to the race of the Titans. When the latter dethroned Cronos in order to make Zeus the king of heaven, Prometheus was in favor of employing artifice instead of violence. He guided Zeus by his advice, and may therefore claim the distinction of being the founder of the new dynasty of gods. Subsequently, however, he disagreed with Zeus when the latter, after assuming the government of the world, forgot the mortals in the distribution of his favors, and even intended to destroy them. Prometheus then stole a ray of heavenly fire, and in spite of Zeus took it down to man, whom he taught its uses in the various arts and sciences. He also instructed mankind in the ceremonies of a sacrificial worship, in which the gods received the honor of the offering, whilst the profit yielded by the victim was reserved for man; for he made them divide the bodies of the sacrificial animals, so that only the bones and the kidney fat were consumed in honor of the gods, whilst the skin, flesh, and sinews, were saved for terrestrial uses.

Enraged at such proceedings Zeus resolved to visit mankind with his wrath. He ordered Hephæstos to make a woman of water and clay, whom the other deities endowed with their best gifts, beauty, loveliness, sagacity, charming eloquence, and so forth. This woman (*pl.* 23, *fig.* 16) was called *Pandora* (the all-gifted). Zeus provided her with a closed casket calculated to make mankind wretched, and sent her as a present to Prometheus, with a view that he should bequeathe her as a precious heavenly gift to his favorites the mortals. In this casket Zeus had locked up every human misery, and no other good but *hope*, which he had placed at the bottom. Prometheus, who suspected the nature of the gift, refused to take it, and warned mankind and particularly his own brother *Epimetheus* (after-thought) against it, to whom Zeus had sent it by Hermes when Prometheus had rejected the offer. But Epimetheus was beguiled by the lovely woman, whom he could not suspect of uniting with so much loveliness qualities that would prove dangerous as soon as they were liberated from their confinement. His curiosity prompted him to open Pandora's casket, when at once sickness, care, vice, and every other curse escaped and spread among mankind. Hope alone remained behind, and henceforth offered to mankind the only consolation when Pandora's other gifts in their unrestrained sway threatened to overwhelm them.

But it remained for Zeus to wreak his vengeance on Prometheus himself for opposing his will and attempting to frustrate his design by warning mankind against Pandora's casket. He caused him to be chained to Mount Caucasus, and sent a vulture which daily tore out and devoured his liver,

which nightly grew again to renew his agonies on the following day (*pl.* 23, *fig.* 15). There he was to remain for three thousand years; but *Heracles* slew the vulture, broke the fetters, and prevailed upon Zeus to admit Prometheus into Olympos, where his sagacity and shrewdness were of much service

2. Perseus, son of *Zeus* and *Danaë*, was immediately after his birth placed in a box together with his mother, and thrown into the sea by her father *Acrisios*, who feared the fulfilment of a prediction, according to which he would be killed by his grandson. The box was carried by the waves to the island of *Seriphos*, where both mother and son were kindly received by King *Polydectes*, who was so enchanted by the charms of Danaë that he demanded her in marriage. She managed, however, to defer such an alliance on the plea that her son should first grow up to be a youth and go forth to procure her an adequate dower. When the time came, the intrepid youth boldly offered to bring Polydectes the head of *Medusa*, one of the *Gorgons;* and Polydectes, who wished to rid himself of the youth, who seemed unfavorable to his attachment for Danaë, and hoped he would perish in the bold attempt, accepted the offer of Perseus, who accordingly undertook the dangerous expedition.

The Gorgons were three sisters, monsters girt with serpents, and having serpents instead of hair. They had also brazen hands and wings, and huge boars' tusks; and so stern was their aspect that every mortal that beheld them was converted into stone. They were immortal, with the exception of Medusa (*pl.* 26, *fig.* 10; *pl.* 30, *figs.* 13 *a*, *b*). Their residence was beyond the ocean on the frontier of night (west Europe), and the way thither was full of dangers and almost unknown.

Perseus obtained for his perilous undertaking the assistance of Hermes and Athene. Accompanied by them he went to the *Grææ*, the guardians of the only weapons with which Medusa could be slain. They were, according to Hesiod, two misshapen spinsters, *Pephredo* and *Enyo*, who had only one eye and one tusk in common, which they used alternately. Æschylus states them as three in number, and later writers allude to them by the names *Pemphildo* or *Emphildo*, *Ento*, and *Yæno;* still others as *Pephredo*, *Enyo*, and *Chersis* or *Deino*.

Perseus subdued the Grææ and took away their tusk and eye, which he withheld until they delivered to him the weapons he wanted. They then procured for him a pair of winged sandals, the helmet of Ares with the power of making the wearer invisible, a silver bag and a diamond sickle, to which Athene added a brazen shield of such splendor that he could use it as a reflector in which to see the image of the head of Medusa, lest beholding the head itself he should fall under the doom of other mortals and be converted into stone. Thus equipped he began his expedition. *Pl.* 30, *fig.* 11, represents him preparing to start.

His winged sandals carried him speedily to an island, where he found the Gorgons asleep. Approaching them with averted face, guided by the reflection from his shield, he severed the head of Medusa from her body with one blow of his sickle. *Pl.* 30, *fig.* 12, represents him with the head in one hand, the sickle in the other, and the bag hanging at his arm. From

the stream of blood flowing from the slain Gorgon arose *Chrysaor* (the man with the golden sword), and *Pegasus*, the winged horse (*pl.* 25, *fig.* 21). Perseus now thrust the head into the silver bag, and mounting Pegasus, fled from the island.

The two sisters of Medusa, *Stheno* and *Euryale*, aroused by her death-cry, called to their assistance Poseidon, to whom they related the calamity of their sister (*pl.* 30, *fig.* 10). They are represented in short tunics, and their broad tongues protrude between the long teeth of their horrid mouths. To the left stands the Nymph who directed Perseus to the retreat of the Gorgons. They pursued the murderer; but the helmet which made him invisible, and the speed of Pegasus, enabled him to escape unhurt. He sped his course over Africa, and wheresoever the blood-drops fell from the dripping head upon the ground, they took the form of poisonous serpents, and ever since that region has been infested with venomous reptiles. On his way he stopped with *Atlas* (King of Ethiopia), who had beautiful gardens and trees which bore golden apples. It had been predicted to Atlas that he should lose his gardens by a son of Zeus, and hearing that Perseus was such, he denied him the common rites of hospitality. In return for his neglect, Perseus, by the head of Medusa, changed him into Mount Atlas, reaching to the clouds, and which must support the vault of the heavens. Hence the allegorical representation of Atlas with the celestial globe on his neck (*pl.* 30, *fig.* 24).

The winged horse Pegasus was afterwards transferred to Olympos, and carried Zeus's thunder and lightnings. He also became associated with other myths, particularly with that of the Muses, and became thereby the steed of the poets; hence the expression in regard to poetical efforts, "to mount Pegasus."

Returned to Seriphos, Perseus liberated his mother from the persecutions of Polydectes, by changing him into stone with the head of Medusa. He then gave the helmet, bag, and the winged sandals to Hermes, and the head of Medusa to Athene, who decorated her ægis with it. After numerous other exploits he was placed by Zeus among the constellations.

3. Bellerophon was the son of *Glaucos*, King of Corinth, and originally bore the name of *Hipponoos*, but having murdered his relation *Belleros*, he was compelled to flee from the city, and his name was changed to *Bellerophon* (murderer of Belleros). Lycia, the country to which he escaped, was infested by the *Chimæra* (*pl.* 30, *fig.* 26), a monster with the heads of a lion and of a goat, a lion's body, and a tail which terminated in a snake. It devoured the flocks, vomited forth fire, and burnt the forests aud dwellings all over the country. At the command of *Jobates*, King of Lycia, Bellerophon undertook a combat with this monster. Pallas Athene procured him the winged horse Pegasus, and having obtained this precious assistance, he took leave of Jobates and began his expedition (*pl.* 30, *fig.* 25). The Chimæra sent forth its fiery breath against him, but in vain. He shot arrows at it from a distance, and when these proved unavailing he hurled huge masses of lead down the throat of the monster, which finally yielded to his superior prowess.

After this, Jobates sent him against the *Amazons*, a nation of warlike women, who having first dismissed their husbands, admitted no men amongst them. Wherever they made their incursions, they hunted and slew all that belonged to the male sex, but captured and bore off the virgins. They were usually represented as in *pl.* 30, *figs.* 27, 28. Bellerophon set out against these women, mounted upon Pegasus, whose appearance so frightened the horses of the Amazons that they became uncontrollable, and running off, dashed their riders over precipices, or flung them into rivers.

The hero had now accomplished his two difficult tasks, and returning to the capital crowned with glory, he received in marriage the daughter of Jobates, who also appointed him his successor. His good fortune, however, having made him overbearing, he boldly attempted to ride up to Olympos on Pegasus, but Zeus, to punish him for his presumption, sent a gad-fly, which so irritated the horse that he threw his rider to the earth. Mortified and dejected, he ever after shunned the society of men, and spent the rest of his days wandering through lonesome and desolate regions.

4. The Dioscuri (*Castor* and *Pollux*) were sons of Zeus and Leda. Pollux inherited the gift of immortality from his father, but Castor was mortal. They were both extraordinary youths, and enjoyed in an equal degree the favor of the gods. Inseparably united, they undertook and accomplished numerous and celebrated heroic achievements, and participated in those of others. They joined Heracles in his war against the Amazons, Jason in his expedition to Colchis in search of the golden fleece, and Peleus in his attack upon Iolchos. They loved the daughters of *Leucippos*, one of the participators in the pursuit of the Calydonian boar, in which the Dioscuri also took part. These virgins, *Phœbe* and *Ilæira*, were also loved by the brothers *Lynceus* and *Idas*, kings of Messenia, who disputed the claim of the Dioscuri. In the combat that ensued, Castor fell by the spear of Lynceus, and Pollux, inconsolable for his loss, implored the gods to share with Castor his immortality. Zeus answered his prayer, and placed both among the stars, where they form the constellation of Gemini. They were usually represented as handsome youths in the full vigor of health (*pl.* 18, *fig.* 10), or as symbols of the constellation on horseback, with the figure of night between them, and accompanied by their stars (*pl.* 20, *fig.* 3).

5. Heracles (Hercules), son of Zeus and Alcmene, was the most celebrated hero of the Grecian mythology, in whom poetry has represented the ideal of human perfection as it was understood in the heroic age, endowing him with the greatest possible bodily strength, together with the best qualities of mind and heart recognised in that age. His mother was the consort of King *Amphitryon* of Mycene, and bore, together with Heracles, his twin brother *Iphicles*, who betrayed his inferior origin, when *Amphitryon*, in order to ascertain which of his children was of godly descent, threw two snakes into their cradle. Iphicles started back, whilst Heracles seized both the snakes and strangled them (*pl.* 25, *fig.* 14).

Heracles was carefully educated by the greatest men of his age, and became an expert charioteer, wrestler, archer, and warrior, and well versed

in the healing properties of plants. But his hand seemed little skilled for acquiring the art of music; and when his teacher *Linos* one day gave him a severe correction, he killed him with the lyre, for which crime he was punished by Amphitryon, who sent him to his shepherds to assist them in guarding the vast herds of the king.

When he had reached the age of eighteen, he left the herds and set out in quest of adventures. Arriving at a cross-road, he was met by two females, each of whom sought to secure his confidence to herself. The one was endowed with the most inviting charms and allurements, and promised him, if he would follow her, exemption from all toils and disquietude; her name was *Vice.* The other exhorted him to follow her and to gain eternal renown, and a final admission to Olympos, by conquering in a manly way the troubles and dangers which would obstruct his path, but which would yield to his strength and earnest will. Though less beautiful than the first, a noble and majestic mien made her peculiarly attractive; her name was *Virtue.* The youth yielded to her persuasion, and promised ever to follow her.

The trials predicted by this patroness were not long delayed. The ever jealous Hera wished to destroy him, and extorted from Zeus a promise to place him in the service of King *Eurystheus*, who should assign him twelve commissions (commonly known as the twelve labors of Heracles), his ultimate freedom depending upon their completion, and consequently Heracles was sent by Zeus to his severe taskmaster.

The *first* labor he was bid to perform was *to slay the Nemean Lion.* This beast lived in the forests of Nemea, desolated the country in every direction, and seemed to be invulnerable to all the shafts of mortals. Even the weapons of Heracles produced but a slight effect; the lion rushed at him more furiously than ever; he dealt him a blow upon the head with his club, which was shivered, though it staggered the lion; then following up his advantage, he caught him round the neck and finally strangled him (*fig.* 15). He tore off the skin, which ever afterwards served him as a coat of mail, the head being his helmet.

His *second* labor was the *destruction of the Lernæan Hydra.* This monster had one hundred heads, one of which was immortal, while whenever one of the others was cut off it was instantly replaced by two new ones. When Heracles attacked the Hydra it wound around his feet, and he soon found that although he cut off many of its heads, their number increased instead of becoming less. He then bid his charioteer set fire to a neighboring wood, and seizing a burning tree, applied the huge torch to the fresh wounds he made, thus paralysing the reproductive faculty (*fig.* 17), until all the heads were destroyed except the one which was immortal, and that he placed in the ground beneath a heavy stone. Then cutting the body to pieces, he dipped his arrows in its blood, which rendered the wounds inflicted by them incurable. Eurystheus declared the labor ill performed, as it had been accomplished with the assistance of the charioteer, and gave him another task more difficult to execute.

This *third* labor was to *take alive the Hind of Artemis*, the swift-footed

Cherynitis. Heracles chased it during a whole year, even into the Hyperborean regions, until he succeeded in laming it by sending an arrow through its foot; when he soon caught it and carried it on his shoulder to Eurystheus.

The *fourth* labor was to *take alive the Erymanthian Boar*, which was also sacred to Artemis. This terrible animal lived near mount Erymanthos, which it rendered so unsafe by its ravages that no traveller dared approach it. On his way thither Heracles first conquered the Centaurs and drove them from Arcadia. He then attacked the boar and chased it into the deep snow of the mountain top, where he caught it and carried it home. When he brought it to Eurystheus, the latter was so frightened that he hid himself in a cask, and became so afraid of the hero that he transmitted his further orders to him through *Copreus*, forbidding him henceforth to enter the city of Mycenæ.

The *fifth* labor was to *clean the stables of Augeas*, in which the latter had kept three thousand head of cattle for a long period. This task he accomplished by leading the rivers *Alpheios* and *Peneios* through the stables, which were effectually cleaned by the rushing waters.

The *sixth* labor was *to slay the Stymphalides*, rapacious birds with brazen bills and iron wings, whose feathers they could shoot like arrows against their pursuers. They lived in the swamp *Stymphalis* in Arcadia, and could not be approached. Heracles frightened them out of their retreat by the noise of a huge rattle, and then laid them low with his deadly arrows, the birds not being proof against the poison of the Hydra.

The *seventh* labor was *to catch the Cretan Bull* which Poseidon, in his wrath against king *Minos*, had brought to Crete to devastate the island with his fiery breath. Heracles mastered the furious animal, and brought it to Eurystheus, who sent it into the plains of Marathon, where it spread death and destruction until it was finally caught by *Theseus* and sacrificed to Apollo.

The *eighth* labor was *the capture of the horses of Diomedes*, king of Thrace. These four dreadful horses were fed with the bodies of all the strangers that strayed into the territory of Diomedes. Heracles slew their guard and led the horses to Eurystheus, in spite of the pursuit of the Thracians.

The *ninth* labor was *to fetch the shoulder-belt of the Queen of the Amazons*, *Hippolyte*, which *Admeta* daughter of Eurystheus coveted. Heracles went to Hippolyte and persuaded her to give up her belt, but Hera instigated the Amazons to attack him. Believing that this attack was owing to the treachery of Hippolyte, Heracles slew her and took the shoulder-belt by force.

The *tenth* labor was *to steal the cattle of Geryon*, the three-headed giant-king of Iberia and the Balearic Islands, which were guarded by the two-headed dog *Orthros* and the giant *Euryton.* Heracles slew both the latter and drove off the cattle, but he was pursued by Geryon, who was assisted by Hera, and attacked him furiously. Heracles, however, succeeded in wounding Hera in the breast, and whilst she hurried to Zeus to get him to paralyse the poison, he slew Geryon and drove the cattle successfully to Mycenæ in spite

of Hera's renewed endeavor to frustrate his labor by enraging the animals on a wide plain, where he had the utmost difficulty in keeping them together.

The *eleventh* labor was *to fetch the Golden Apples of the Hesperides*, the daughters of *Hesperos*, who lived near Mount Atlas. But Heracles knew not where the apples were to be found. He first asked the nymphs of the *Eridanus*, who referred him to *Nereus*, who refused to answer. Heracles then fettered him and compelled him to tell what he knew. The way he indicated led through Lybia, Egypt, and Asia, to the Caucasus. Here Heracles found the fettered Prometheus, whom he liberated after slaying the torturing vulture, and the grateful Prometheus told him that he must apply to Atlas for the apples. Thither Heracles then went and asked him to procure him the apples, offering at the same time to support the heavens for him during his absence. When Atlas returned with the apples he was little inclined to re-assume his office and its burden, but preferred himself to take the apples to Eurystheus. Heracles apparently consented, and only asked that he should hold the heavens until he could place a cushion on his own neck to make the weight less painful. But when Atlas had taken on himself the burden, Heracles took the golden apples and returned with them to his lord, who almost despairing at the invariable success of Heracles in all his undertakings, had in reserve a new task, the last he had authority from Zeus to impose, but which he was sure would accomplish the wish of his patroness Hera, and prove the destruction of the hero.

This *twelfth* labor was *to bring up Cerberos from the Lower World*. Cerberos was the three-headed dog guarding the shades in the realm of Hades, the monstrous son of Typhon and Echidna, and was covered with serpents instead of hair, had a dragon's tail, and his breath and froth were poisonous. For this exploit Heracles had to prepare himself by being initiated into the mysteries by *Eumolpos* of Eleusis. This initiation is symbolically represented in *pl.* 25, *fig.* 18, by the myrtle twig in the hand of Heracles, and the scarf over his head, similar to that which is handed him by the priestess of *Arete* (virtue), who stands in front of him with an inverted spear.

After going through the ceremonies of initiation he descended to the infernal regions. The shades took flight when he descended among them. *Menœtius* alone, the cattle-keeper of Hades, dared to oppose his progress, when he undertook to kill some cattle in order to slake the thirst of the shades with their blood, but Heracles dashed him against a rock and broke his ribs. He then demanded of Hades his dog, which the latter consented to give up provided Heracles could secure him unarmed. The hero at once seized the monster, and pressing his three heads between his knees, fettered him (*pl.* 25, *fig.* 16). When he brought him up to Eurystheus, the affrighted king begged him to take him back to the lower world, which he did.

Heracles was now free from his allegiance to Eurystheus; but still subject to the persecutions of Hera he continued his wanderings, in which he established altars in honor of Zeus and accomplished many a heroic

deed, of which we briefly mention his combat with *Echidna*, who had stolen his horses whilst he was asleep, his war with the *giants*, and his contest with Apollo for the tripod, which he wanted in order to establish an oracle of his own. At length Zeus succeeded in appeasing the wrath of Hera. No longer instigated to activity by the dangers she had thrown in his way, he grew weary of life, and erected a huge pyre on Mount Ætna on which he placed himself and ordered his friends to light it; but they refused, and he then bribed the shepherd *Poias* to do it by giving him his arrows. Scarcely had the flame enveloped the pyre when a cloud descended from heaven, which caught up the hero and bore him to Olympos, where he was received into the circle of the gods and was married to Hera's daughter Hebe.

The whole myth of Hercules is obviously the symbolical account of the progress of civilization through the energy, strength, and virtue of man, for he prepares the land for cultivation by destroying the wild beasts which infest it; he shows the way to navigation by crossing and re-crossing the ocean and by his intercourse with many different races; and he directs the mind of man to the divine being, as the source of all success, by erecting altars and arranging worship.

At a time when lasciviousness and effeminacy had polluted the minds of Grecian poets, a number of degrading adventures were connected with the name of Heracles, which, however, are so foreign to the fundamental idea of this mythological figure, that we merely allude to the fact without giving room to the accounts in our pages.

The artistical representations of Heracles are always of colossal proportions, expressive of the greatest imaginable degree of human strength. His features are usually serious, but calm and mild withal, as it behoves a stern, awe-inspiring, but worthy and great character, who is above the common meanness of man. His attributes are the club and the lion's skin, which constitutes his only clothing. We have copied (*pl.* 15, *fig.* 24) the statue of the *Tyrrhenian Heracles.* Other representations of this hero will be found in the division of our plates devoted to Sculpture, as he was at all times a favorite subject for plastic representation.

6. Œdipous (Œdipus) was the son of *Laios*, King of Thebes, and was celebrated not less for his misfortunes than for his exploits. An oracle had informed his father that the son of his wife *Jocaste* would slay him; and to avert such a fate he had him exposed soon after his birth on Mount Cithæron. Before sending him away he had his ankles pierced and a leathern thong inserted in the wounds, whence his name (swollen foot). A neatherd found him and presented him to the childless *Polybos*, King of Corinth, who adopted him as his heir. When he grew up and learned that he was not the king's son, he inquired who were his parents, but failing to receive satisfaction he repaired to the oracle at Delphi. The response was: "Avoid thy home, if thou wouldst not murder thy father and marry thy mother!" To escape such a calamity he resolved to abandon Corinth, which he regarded as his native place, and make Thebes his home. His father Laios happened to be on the way to consult the

same oracle in regard to his son, and the two met in a narrow part of the road in Phocis. The king's charioteer ordered Œdipus to clear the way. He disregarded the command, a contest ensued, and both Laïos and the driver were killed.

Unconscious of being his father's murderer, he now proceeded towards Thebes. At that time the country was desolated by the *Sphinx* (*pl.* 30, *fig.* 18, *a*, *b*), a monster with the head and breast of a lovely young woman, the body of a winged lion, and the tail of a dragon. She propounded to every passer-by the riddle, "Who walks on four feet in the morning, on two at noon, and on three in the evening?" and whoever failed to solve it was devoured. To rid themselves of this dreadful evil, the Thebans offered as a prize to the man who should answer the sphinx, the now vacant throne of Laïos, and the hand of his widowed queen. Œdipous hearing of the proposal, boldly approached the monster and answered "Man does! As an infant he creeps on hands and feet, during manhood he walks on two feet, and when old uses a staff." The sphinx could not survive the solution, and cast herself down a precipice; or according to some authors was slain by Œdipous (*fig.* 20). The latter now became king of Thebes and husband of his mother Jocaste, who when the dreadful fact became known hung herself in shame and despair; while her unhappy son, as an expiation for his unintentional crime, deprived himself of sight, went into a voluntary exile, and finally took leave of the earth without pain or sickness, and at peace with the gods, whom his sufferings had induced to pardon his crime.

7. Odysseus (Ulysses) son of *Laertes* and *Eurycleia*, and king of Ithaca, was married to *Penelope*, who had borne him a son *Telemachos* at the time of the commencement of the Trojan war. The oracle having predicted that he would not return for twenty years if he joined the expedition, Odysseus was averse to leaving his happy home. When therefore *Menelaos*, *Agamemnon*, and *Palamedes* came to Ithaca with a view of inducing him to join their efforts to liberate *Helen*, he feigned madness, harnessed an ox and an ass to his plough, and sowed salt. But Palamedes discovered the deceit by placing Telemachos in front of the ploughshare, which Odysseus carefully lifted over the infant. He had then to lay aside his mask and yield to the persuasion of his friends. In the expedition against Troy he rendered important services to the besiegers by his sagacity and cunning, which knew how to turn to account the most untoward circumstances. After the sack of Troy he started on his voyage home, but a storm threw him on shore in the territory of allies of the Trojans, who attacked him, and whom he had to conquer before he could proceed on his voyage. Another storm drove his vessel to the land of the *Lotophagi* (lotus-eaters), with which his companions were so pleased that he had the greatest trouble to make them re-embark. He was next carried by contrary winds to Sicily, where he and his companions sought refuge from the inclemency of the weather in a cavern, which was the residence of the gigantic Cyclops *Polyphemos*, who, on returning with his flocks from their pasture, found the intruders, and locked them up by placing a huge rock before the entrance of his cave. Every day he swallowed one of the companions of Odysseus, who however finally

hit upon a plan for saving himself and his remaining followers. He first intoxicated the giant, and burnt out his only eye whilst he was asleep. The enraged monster dealt mighty blows in all directions, but his captives easily evaded their blind antagonist. One morning when Polyphemos removed the rock from the entrance of the cave in order to let out his flock of sheep, Odysseus and his friends each slipped under a ram holding on to its fleece, and were thus carried out under the very hands of the Cyclops who stood in the passage feeling the animals' backs as they passed him. Odysseus then re-embarked, but having offended Poseidon by maiming his son Polyphemos, he had to go through a vast deal of suffering on his further voyage. When his own island of Ithaca was already in sight Poseidon bid *Æolus*, the god of the winds, drive him back. He was first thrown on the Æolian islands, then on the land of the *Læstrygons*, and finally on the island of the nymph *Circe* (*pl.* 30, *fig.* 16), who changed his companions into swine, but could not transform him as he was guarded against witchcraft by a mystical plant that he had obtained from Hermes, and by whose power he also forced her to restore the original forms of his companions.

Leaving the island he again encountered storms that threw him into the neighborhood of the abode of the Sirens, half birds, half women (*pl.* 21, *figs.* 17, 19), who by their charming song lured mariners into danger, and either drowned them or changed them into Sirens (*fig.* 18). Odysseus escaped the danger by causing himself to be lashed to the mast of his vessel, and his companions to close their ears with wax. Thus he passed the dangerous spot unhurt, but was soon after carried by the winds into the narrow passage between *Scylla* and *Charybdis*, of whom the myth relates that they had been beautiful maidens, and were changed into sea monsters by Circe from motives of jealousy, and stationed in the Etruscan straits to render them attractive by their alluring charms and destructive by their monstrous nature. Odysseus came too near Scylla, who slew six of his companions (*pl.* 30, *fig.* 15), and in his endeavor to escape from the spot fell in with Charybdis (*fig.* 14), who also claimed a number of victims. But he at length extricated his vessel from the dangerous neighborhood. He was not, however, yet freed from the persecutions of the vindictive god of the seas, who sent another gale against him which wrecked his vessel on the island of the Nymph *Calypso*, when all his companions were drowned, and he alone saved by his skill in swimming. Calypso retained him on the island for seven years, when he was finally released at the command of Zeus, who at the request of Athene sent Hermes to bid Calypso give him a vessel that he might continue his voyage. Scarcely had he, however, lost sight of the island when Poseidon again sent a gale of wind that he might destroy him; his vessel was shivered by the force of the waves. After swimming during three days he reached the island of Scheria, where he fell down exhausted and sank into a deep sleep. He was found by the daughter of King *Alcinoos*, who offered him the hospitality of her father. The latter instituted a great feast in honor of his guest, at which *Demodocos* sang the glorious deeds of the Greeks at Troy. Elated by the song, Odysseus dis-

covered himself and recounted his own adventures and disasters. Touched by the hardships of his voyage, Alcinoos resolved to have him brought to Ithaca by one of his own vessels. Odysseus was sleeping when the vessel reached his home in the dead of night. His companions carried him on shore, and left the island after having placed him gently on the beach. When he awoke he knew not where he was. Twenty years of absence had effaced the recollection of the scenery around him. Athene, in the shape of a shepherd, told him he was in Ithaca, but not until she had assumed her own divine form would he believe her word, so firmly had the idea become rooted in his mind that he would never reach his island again.

Athene bade him assume the garb of a beggar, and thus approach his palace, and to address himself under this disguise to *Eumæos*, an old, faithful servant. He was kindly received by the good old man, whom he told that Odysseus was still among the living, but had difficulty to make him credit that he knew he was not far off. On the third day Telemachos made his appearance returning from his voyage in search of his father, and to him Odysseus discovered himself. Eumæos was then dispatched to inform Penelope of her husband's approach.

Penelope had long been hard pressed by numerous suitors, who had spread the report that Odysseus had perished at Troy. But the virtuous woman was true to her lord, and deferred an answer to their suits by promising to bestow her hand upon one among them when she should have finished the shroud of Laertes which she was weaving. She wove at it every day, but undid her day's work during the night, and thus delayed the ominous decision. Meanwhile the haughty wooers established themselves in her palace, banqueted in her halls, and squandered the wealth of her house. When Eumæos brought her the message she bade him bring to her the beggar who had sent it. When he entered the hall he found the wooers at a feast, and they taunted the ragged man and made him wrestle with the privileged beggar of the house for their amusement. When brought into the presence of Penelope he told her, who did not recognise him, that her lord lived and would return to his home on the following day. Rejoiced at the news, she arranged a feast for that day, and told her suitors that she would upon that occasion give her decision in favor of one. After the feast she ordered the bow of Odysseus to be brought into the hall, and promised her hand to him who could shoot an arrow from that bow through twelve holes at the top of so many stakes that were placed in a straight line at short distances behind each other. When all the lovers had tried in vain to bend the bow, the disguised beggar asked permission to try his skill, and at the command of Penelope and Telemachos the bow was reluctantly handed to the despised old man. He raised it slowly and with apparent difficulty, but suddenly drew the string with perfect ease and sent the arrow from it through all the stakes. Before the proud suitors could recover from their astonishment he had thrown off his disguise and sent another arrow through the breast of the boldest of the lovers, and then, with the assistance of Telemachos and Eumæos, he killed the rest. Penelope now recognised her lord by his uncommon prowess and welcomed him home.

The death of Odysseus is enveloped in mystery. The most common version is that he was killed by *Telegonos*, the son of Circe, who had landed on Ithaca as a pirate, and was opposed by Odysseus and Telemachos.

The term *hero* was applied not merely to the demigods, as already suggested, but also to worthy and honored men of great antiquity. Thus Homer employs it in speaking of princes and their sons, nobles, generals, their aids and companions. Of this class of heroes we give two representations in *pl.* 16, *figs.* 5 and 6.

13. The Giants.

We have alluded to the Giants while treating of Zeus. They were monsters of astonishing size and invincible strength, and their dragons' tails and feet gave them a hideous aspect. They sprang from the blood which issued from the wounds of Uranos; or according to another myth, Gaia brought them forth to spite her husband.

The most noted were *Mimas*, who, in the contest between his race and the Olympic gods, was transfixed by Ares (*pl.* 30, *fig.* 21); *Pallas*, who was slain by Pallas Athene while fighting against her with his snaky tails and a shepherd's crook (*fig.* 22); and *Gration*, who fought with a stag, or with Artemis in the form of a stag (*fig.* 23).

14. The Pygmies.

The Pygmies, the complete contrast to the Giants, were a fabulous race of dwarfs (the Liliputians of modern times), whose most formidable enemies were the Cranes. *Fig.* 29 presents a battle between them. Two of the Pygmies are armed with lances, and carry a skin on the left arm as a shield; a third is hastening to the aid of a prostrate comrade. Heracles once fell asleep in the deserts of Africa, when an army of Pygmies attacked him with as much energy as though they had been besieging a town. The hero awoke during the onset, smiled at his puny foes, but was so much pleased with their courage, that he gathered them in his lion's skin and carried them to Eurystheus.

15. Sacred Animals.

The Greek system of mythology abounded in sacred animals. We have already spoken of *Apollo's raven* (*pl.* 17, *fig.* 28). In *pl.* 28, *fig.* 26, we have represented the *sacred bull of Dionysos.* His body is girded with an ivy branch, and he stands upon a thyrsus adorned with ribbons. The inscription designates it as the work of the artist *Hyllus*, who wrought the stone from which our engraving is copied. *Pl.* 24, *fig.* 9, presents the *sacred lion* which Dionysos or one of his attendants is feeding. This piece

is a part of the frieze on the monument of Lysicrates, generally known as the lantern of Demosthenes, and illustrates the history of Dionysos and his punishment of the Tyrrhenian pirates. Finally, we give the *sacred serpent* (*fig.* 10 *a b*), copied from a coin called the *cistophorus*, because it exhibits the *cista* or sacred box, surrounded by ivy, berries, and leaves, from which the serpent proceeds. The reverse bears two serpents with their tails entwined; between them is seen a quiver, and to the right a thyrsus, around which a serpent is coiled.

16. The Genii.

We close our account of mythical beings by a brief reference to the *Genii* (*pl.* 19, *fig.* 10). They were originally regarded as gods, but at a later period they held a position between gods and men. They constituted two distinct orders: the *Good Genii* (*Agathodæmons*), and the *Evil Genii* (*Cacodæmons*). They were considered mortal, and had a very limited sphere of activity. Every man was supposed to have two. The good one counselled and encouraged him, the evil one sought to corrupt him; and thus they waged a perpetual strife, the victory depending upon the will of the individual, who had it in his power to retain or reject either; and while one remained in power, the other abandoned him. Accordingly it was customary to ascribe good fortune or disaster to the presence of the good or evil genius.

They were usually represented as handsome youths, sometimes winged and crowned with wreaths, and clothed in a star-embroidered garment, sometimes without any of these, and naked.

Theology and Worship of the Greeks.

The belief in the existence of the soul after death and an appropriate retribution of good or evil was universal among the Greeks, though, as might be expected, the notions on these subjects were gradually modified in different ages. The abode of departed spirits was the centre of the earth, and was divided into two distinct regions, *Elysium*, the place of reward, and *Tartaros*, the place of punishment. Hermes with his golden wand escorted the souls down to the lower world, to the lake *Acherusia*, which was formed by the junction of the rivers *Cocytos* and *Styx*. Over this lake they were rowed by *Charon*, the ferryman of the lower world. He was a severe old man with a dingy dress, and for two *oboli* (a small Greek coin) bore across to Hades in his leaky boat the souls of those who in the upper world had been burned or at least consecrated to Hades by a monument (*pl.* 24, *fig.* 24); those, however, who had not these pre-requisites were compelled to wander on the terrible shore during one hundred years. When landed on the opposite shore of the lake, they passed through a cavern in which *Cerberos* kept watch, to the world of shades. From this

there was no return. They next entered a large court, where *Minos*, the first supreme judge of the dead, passed judgment upon the acts of their lifetime, and decided whether they should be admitted to *Elysium*, where *Hades* and his queen *Persephone* reigned, or go to *Tartaros.* Around Elysium flowed the crystal waters of *Lethe*, from which the departed drank and forgot for ever the sorrows of the past. Meadows of loveliest green lay stretched out before their view; they were decorated with the most beautiful flowers and dotted with shady groves; a clear and serene atmosphere filled the cloudless firmament, which was gladdened by everlasting light. The land brought forth of itself its refreshing fruits three times in the year; and old age, pain, and disease were displaced by perpetual enjoyment and delight. *Tartaros*, on the contrary, which lay far beneath the world of shades, was a deep abyss inclosed by a triple wall and by the fiery stream *Phlegethon* and the raging *Acheron.* Those whom Minos directed thither were taken before a second judge, *Rhadamanthos*, who determined their penalty according to the measure of their guilt. The moment the decision was announced, the *Erinnyes* appeared and drove them into the place of punishment, where they remained for ever. Some of these dreadful punishments are represented in *pl.* 24, *fig.* 25, where we see *Sisyphos*, once king of Corinth, who was condemned to roll a large stone up the side of a steep hill, and when he had just gained the summit the stone recoiled, carrying him with it to the base, by which his labor was ever beginning and never ended. Another sufferer, *Ixion*, king of the *Lapithæ*, was bound to a wheel which revolved perpetually, and after plunging him into the flames of sulphur raised him aloft only to submerge him again beneath the fiery waves. *Tantalos*, king of Phrygia, tormented by endless hunger and thirst, stood immersed to the chin in water, while over him hung a tree whose branches bore the most delicious fruits; but whenever he stooped to drink the water shrank from his taste, and when he reached forth his hand for the fruit, the branches receded beyond his grasp.

The modes of worshipping the gods were as varied as the deities themselves. The sacred places were at first certain tracts of land whose products were dedicated to the service of the deities; next consecrated groves, in which altars were erected in the open air. At a later period temples were built, some to particular gods, the greater part, however, to all the gods, and the latter class of temples bore the name of *Pantheon.* The worship consisted chiefly of prayer, sacrifice, and public festivals and games, which varied, of course, with the character of the god. The style of private sacrifices differed also somewhat according to the wealth of the worshipper. In conducting the religious services, numerous and diversified implements were employed, some of which were finished in the highest style of art. We present drawings of altars (*pl.* 19, *figs.* 19, 20); sacrificial vases (*figs.* 21–29); offering cups and dishes (*figs.* 30–33); incense caskets (*figs.* 34, 35); a tripod (*fig.* 36); a brush of hair for sprinkling the consecrated liquids (*fig.* 37); various knives, dipping ladles, &c. (*figs.* 38–47); a large sacrificial knife (*pl.* 17, *fig.* 29), which was used at the sacrificing of a bull; an

altar lamp (*pl.* 16, *fig.* 27), made of burnt clay, having the form of a bull's head with pendants and fillets, and employed in the sacrifice of the same animal; and finally, numerous ladle-, pan-, and shovel-formed implements (*figs.* 28–33 *a b*). On a coin which has reference to the worship (*pl.* 15, *fig.* 24 *a b*), we see on one side *Poseidon*, on the other (probably) *Zagreus*.

Among the festivals of Greece none excelled in magnificence and importance the *Panathenæan*. They were instituted by *Erichthonios* in honor of Pallas Athene. At first they were called *Athenæa*, but after all the independent communities of Attica united in the celebration, they took the name of *Panathenæa* (*pl.* 20, *fig.* 23). The Smaller Athenæa were celebrated in April of each year, the Greater every fifth year. In both the proceedings were somewhat similar. On the first day torch-races took place, the second was spent in gymnastic exercises, and the third was devoted to intellectual contests, the rehearsal of Homeric songs, and the delivery of dramatic poems and orations. Then followed the sacrifices and the banquet. At the Greater Athenæa, the principal ceremonies consisted of a solemn procession, in which the saffron-colored peplos, or sacred robe of Athene, woven by maidens of the first families, and illustrative of the deeds of the goddess, was carried to the temple on the Acropolis and folded around her image. After this, the *peplos* was taken down and hung like a sail upon a ship, which was moved by concealed machinery around the Parthenon. The whole festival was deemed so sacred that the inmates of the prisons were released to take part in it.

Among the feasts in honor of *Dionysos* (Bacchus) were prominent the *Orgies*, a mixture of mystic rites and drunken revelry. They are illustrated by an engraving copied from the lid of a sarcophagus (*pl.* 29, *fig.* 2), in which Dionysos and Ariadne are represented sitting opposite to each other, and between them appears a Faun blowing upon a horn. Near Ariadne we see a Mænad playing upon a double flute, and treading with her foot an instrument which marks the time. *Ampelos*, a youthful favorite of Dionysos, stands in a car drawn by tigers, which are guided by a Cupid who plays on a lyre. To the right are seen the drunken Silenos supported by Nymphs, and a Faun retreating in terror from a mystic box which a Mænad has opened, and out of which a serpent is crawling. A picture of *Bacchanalia* similar to this is given in *pl.* 19, *fig.* 13. The intoxicated Dionysos is carried by Pans and Genii, a Faun playing on a tambourine leads the procession, one Mænad plays a double flute, and another appears to be placing a wreath on Dionysos, under whose feet walks a goat, the destined victim of the day.

In *pl.* 25, *fig.* 7, we have copied a picture referring to the *Dionysian Mysteries*. One of the initiated women sits on the back of a bull, which is adorned with garlands for the sacrifice. Her hair is ornamented by a pointed crown; with her left hand she holds up her flowing mantle, while with the right she secures herself on the back of the bull. Behind her walks a man, probably *Axieros* (the Hephæstos of Samothracia), with a conical cap, a lance, and wreath. The other man with a lance probably stands for *Axiochersos* (the Ares of Samothracia). The figure sitting on the

ground and holding a short staff resembling a club is supposed to be one of the initiated dressed as Dionysos. The wreath in the panel shows that the transaction occurred in a covered place.

The *Oracles* of Greece were very celebrated, and constituted a leading object in their religious institutions. They were regarded as the channels through which the gods revealed their will and the events of the future. The oracle of *Apollo* at *Delphi* was most frequented (*pl.* 17, *fig.* 30). *Pythia*, a priestess, sat upon a tripod, and being inspired by the vapor which issued from a fissure in the ground, uttered her strange incoherent words, which were recorded by the prophets, versified by the temple poets, and expounded by the interpreters. Inquirers flocked to this oracle not only from all parts of Greece, but from foreign countries, and the presents with which they endowed the temple made it the wealthiest of antiquity.

The guardians and administrators of the temples were the *priests* (*pl.* 19, *fig.* 17) and the *priestesses* (*fig.* 18). They also took charge of the gifts, superintended the solemn festivals, and adorned the temples for that purpose; and while some performed the sacrifices, others pronounced the prescribed prayers. The Grecian priests, however, never constituted a distinct and independent class, but were subordinate and responsible to other authorities. Besides the priests, the Greeks had their astrologers, dream-interpreters, soothsayers, and augurs, the latter foretelling events by the flight and singing of birds.

II. THE RELIGIOUS SYSTEM OF THE ROMANS.

The primitive religion of the Romans was remarkably simple, being destitute both of temples and images of the gods. Romulus, however, by the erection of a temple to *Jupiter Stator*, laid the foundation of the subsequent mythological system. His successor, Numa Pompilius, introduced material improvements, taking the Etruscan system as his model, and even incorporating several Etruscan elements into Roman worship. As the Roman dominion extended, the principal gods of the conquered nations were gradually received into the mythology of the conquerors, the latter regarding this policy the most effective in permanently attaching a subjugated people to their masters. In this way the deities of the old Asiatic countries, and of Greece itself, at last found a place in the Roman system.

In order therefore to obtain a clear and comprehensive view of Roman Mythology, we propose to examine briefly some of the sources from which it borrowed. As already intimated, it drew largely from the nations of ancient Italy; sometimes adopting a god with no change except the name, and in some instances retaining even that with the slightest alteration. In this connexion none of the old Italians stand forth so prominently as the *Etruscans*, or *Etrurians*, who, prior to the founding of Rome, possessed a finely developed religious system, and exhibited a religious life intimately blended with their political institutions. Their principal god was *Tina*, the

Jupiter of the Romans. Next to him ranked *Janus*. He was god of Time; of the year, which he opened and closed; of the harvest, representing the sun; and acted as mediator between the mortals and the immortals, conveying the prayers of men to the ears of the gods. He appears in this character (*pl.* 15, *figs.* 1 and 2 *a*) with two faces. He was also regarded as an inhabitant of the whole universe, heaven, earth, and sea; the guardian and director of human affairs; and in order to express his omniscience or his powers of seeing into the four quarters of the world at once, he was represented with four faces (*fig.* 2). By the ship-prow at his feet is commemorated the myth that Cronos, after having been dethroned by Zeus, fled to Janus in Italy. Another of their gods, *Tages* (*fig.* 12), resembled the Roman *Amor*. He came as was supposed out of the ground (when a husbandman of Tarquinii was ploughing deep), in the form of a handsome boy, but with the wisdom of an old man; and after teaching the rustic and such persons as had been attracted to the spot by his exclamations of surprise, the knowledge of divine things, of divination and augury by the flight of birds, and the entrails of the animals offered in sacrifice, and they had recorded his words, he instantly died. Among the goddesses of the lower order, the chief was *Voltumna* (*fig.* 20), at whose temple in Viterbo the Etruscan confederation held its meetings. She was goddess of deliberative assemblies, and the patroness of counsellors, senators, &c. *Ancaria* or *Ancharia* (*fig.* 16) also belonged to this class, but was scarcely known beyond the district of Fiesole, the ancient Fæsulæ, where she was worshipped.

The *Umbrians* had a worship and a class of gods very similar to those of the Etruscans; and even the *Sabines*, who in early times possessed a system of their own, afterwards adopted much from the more polished Etruscans. So too the *Latins* were indebted to the common source, though in many particulars their mythology varied from all others. Their first god was *Saturnus*, the next *Neptunus* with his wives *Salatia* and *Venilia*. They recognised a *Jupiter Axur* or *Anxur*, concerning whose meaning and form the ancients themselves did not agree. He is often represented (*pl.* 16, *fig.* 18) as youthful and standing, his left arm enveloped with an *ægis* and serpents, the hand supporting a sceptre; and his right hand grasping three thunderbolts. At his feet sits the eagle, and behind him lies the shield. The inscription refers to the name of the sculptor. Probably the figure is intended to show him in the armor in which he fought the Titans. In *pl.* 17, *fig.* 4, he is represented sitting upon a throne or chair, partially dressed, with a radiant head, and holding in one hand a sceptre, in the other a sacrificial cup. He was regarded in some measure as a wicked god, and goats were sacrificed to him. *Vejovis*, in some respects similar to, and even identical with him (*pl.* 15, *fig.* 22 *a*, *b*), was looked on as an awful being; he was originally an Etruscan god. Others, however, regarded him as a weak, boyish god, incompetent to render assistance. He was represented beardless, and accompanied by a goat. *Opis* or *Ops* (*fig.* 4) was goddess of Shepherds, and when the whole Latin worship came to be blended with the Grecian, she held the rank and position of Rhea.

Roman Mythology proper begins with the myth of *Saturnus.* At first the Romans regarded him as the god of husbandry, but when at a late period his history was blended with that of Cronos, he was honored as the god of Time. As such we see him on a *herma* (*fig.* 3), bearded and winged, with a star above his head, and a globe in his hand. Identified with Cronos, he had of course a similar destiny, dethronement by his son *Jupiter.* Escaping to Italy, he met with a cordial reception from *Janus* (regarded by the Romans as an old Italian king), and obtained for his future residence a beautiful tract of land surrounded by mountains. He now built on the Capitoline (formerly the Saturnian) Hill the city of Saturnia, while *Janus* established himself on Mount Janiculus. Poets have described his reign as the golden age of the human race. Peace, freedom and equality, honesty, confidence, and love prevailed throughout the entire brotherhood of men, and their whole life was devoted to rational enjoyment. No distinction subsisted between the rich and poor, the noble and plebeian; but happiness was universal. To perpetuate the memory of these prosperous times, the *Saturnalia* were founded, a series of festivals which under the emperors lasted from the 17th to the 23d of December, though originally they had only lasted one day. During their celebration the slaves sat at the table and were served by their masters. The most unbounded hilarity prevailed everywhere; the senate adjourned its sessions; law-suits were suspended; punishments were remitted; no war was proclaimed; prisoners were set at liberty, and friends exchanged presents with the view of cementing their friendships.

With the dethronement of Saturnus began a new order or dynasty of gods, into which some that we have mentioned, particularly Saturnus and Janus, were admitted, though with important modifications of their positions. The Romans always distinguished the *invisible deities* (*Dii involuti, superiores*, the veiled or superior gods) who had no special names, from those who were closely related to nature and the human race. The latter were again divided into two classes, the gods of the first order and the gods of the second order. We will now briefly examine the characteristics of the most important deities of these two classes.

1. The Gods of the First Order.

The gods of the first order were collectively called *Dii magni* or *Dii majorum gentium*, and included twelve superior and eight inferior gods.

A. The Twelve Superior Gods.

Six male and six female deities constituted the divine council whose decisions determined the course of all human affairs. These deities corresponded with the twelve Olympian gods of the Greeks.

1. Jupiter (Zeus), the chief and mightiest of all, received among the Romans a far more zealous worship than Zeus did among the Greeks. When he entered upon the government of the universe all the other gods

rendered him homage (*pl.* 17, *fig.* 6). He is seated on a throne with a footstool. Beneath the throne lies the globe, an emblem of his dominion over the world. The diadem, a token of his divinity, adorns his head; one hand grasps the sceptre with which he governs the heaven and the earth, the left holds a thunderbolt. *Juno*, who stands in front of him, wears the diadem as queen of the gods; the others, except *Minerva*, have only frontlets. *Mercury* carries the *caduceus* and a purse; *Apollo*, near Juno, has his hair put up in the form of a double wreath. Of *Diana* we see only the head, and in the original the legs of *Mars* are also visible. *Venus*, the rival of Minerva, turns her back upon her; and between Venus and Mercury appears *Ceres*. Higher up we see the head of *Vulcan* covered with a hat, and behind him *Hebe*, the cup-bearer of the gods. *Neptune* and *Pluto* are wanting, because engaged in their respective empires, the sea and the world of shades.

The exalted rank and worship of Jupiter gave rise to numerous modes of representing him, and created for him many surnames. As *Deus Pater*, father of gods and men (*pl.* 15, *fig.* 5), he appears entirely nude, and holding in his right hand a sceptre as the symbol of his omnipotence. As *Jupiter Conservator* or *Protector* (*pl.* 17, *fig.* 12), he holds the sceptre in the left hand, spreads out his mantle, and extends the right hand with the thunderbolts over the emperor Commodus, who is also represented with the lightnings and sceptre. The inscription signifies "Jupiter the Preserver, Tribune of the People the third time, Imperator the fourth time, Consul the third time, and Father of his country." The copy is taken from a large bronze medal of Commodus.

In Rome alone Jupiter had fifteen temples. In the temple of the *Capitoline Jupiter* (who was patron god of the city and state) the *Sybilline* books (containing the oracles on state affairs) were kept, and all important national transactions were begun and completed. Those who were honored with a triumph deposited in the bosom of his image the laurel twig which they had carried in the procession. The priests of Jupiter ranked higher than others and were permitted to wear purple, the royal color.

2. Juno (Hera) was wife of Jupiter and queen of the gods. She had a temple in Rome and was honored as the patron goddess of the city. She was elevated to this dignity after the conquest of *Veii*, a city which the Romans had besieged for ten years, and which they finally took by means of a subterranean passage which they dug and which happened to terminate in her temple. A soldier asked her statue whether it wished to be removed to Rome. The figure nodded an affirmative, and was taken to the victorious city and located on the Aventine Hill, where the goddess was honored as *Juno Regina* (*pl.* 17, *fig.* 14). As such she is adorned with the diadem and holds a lance and a sacrificial vessel. The Junonian diadem, together with the falling locks and the long ear-pendants, is finely represented on a bust (*fig.* 15). Very similar to the Juno Regina is the statue of *Juno Capitolina* (*fig.* 16). The goddess here rests her left hand on her hip, and holds aloft in her right a part of a shaft. As *Juno Placida* (*fig.* 17) she is seated on a chair, a lance or staff in her right hand, and the

peacock at her feet. *Juno Sospita* (the Deliverer), also called *Lanuvina*, because she had a similar statue at Lanuvium, was represented altogether differently (*pl.* 20, *fig.* 12). She wears over her tunic a goat-skin, which also covers her head, and pointed shoes, a characteristic of the Egyptian pictures of this goddess. She is armed with a lance and shield, the signs of her protecting character. The serpent at her feet is an emblem of health, for which the people supposed themselves indebted to her. It may also refer to the serpent which a little girl of Lanuvium is reported to have fed every year in its cave. The coin supporting these devices is a *denarius* of L. Procilius, a *triumvir monetalis* (member of the board of magistrates who superintended the mint), who chose this device because his family had sprung from the city of Lanuvium.

3. Neptunus (Poseidon) was honored only as the god of horses and the protector of cavalry, in those early times when the Romans had no naval force; afterwards as monarch of the sea he received a very extensive worship. We have copied a fine bust of Neptune (*pl.* 22, *fig.* 7), and *fig.* 7 *a* presents him in full length, on a coin of Titus. He is standing with one foot on a globe as a sign of his dominion over the earth; with the left hand he leans on his sceptre, and with the right he holds an *aplustre*, an embellishment on the stern of a ship.

Fig. 19 is a representation of a sacrifice to Neptune. The statue of the god with the trident and dolphin stands on an altar, at whose base we see a ship and sea-horse. In front stands a smaller altar, on which the fire is burning, and various sacrificial vessels. Priests, surrounded by other officers of the temple, are praying to the god, and in the background appears the destined victim, festooned with garlands. A feast, instituted in honor of Neptune, was celebrated on the 21st of August, termed *Consualia*, from Consus the Etruscan Neptune. At a later period the *Neptualia* were observed on the 28th of July, and for that purpose green bowers were erected on the bank of the Tiber, where refreshments were offered to the people who took part in the games of the festival.

4. Mars or Mavors (Ares), the god of war and son of Jupiter and Juno, received among the Romans a far more distinguished worship than Ares among the Greeks. The most obvious reason for this lies in the fact that the Romans attained their supremacy by war, and thus felt constrained to ascribe their fortune to Mars. They honored him, besides, as the father of Romulus, the founder of the kingdom. The mother of Romulus and Remus was properly *Ilia*, also called *Rhea Sylvia*, daughter of the Albanian King *Numitor*. *Pl.* 27, *fig.* 25 *b*, represents Mars armed with shield, lance, and helmet, and descending to the slumbering Ilia. A herdsman (*Faustulus*) reared the twins; and Romulus subsequently became the founder and first king of what was afterwards the great and mighty Roman Empire. It was on this account that the Romans called Mars *Pater*, as the father of their first king; and in addition to the temple built to him by Romulus, they erected four others, and the successor of Romulus, Numa Pompilius, organized for him a regular system of worship.

The representations of Mars correspond with the Grecian images of Ares,

and he appeared like the latter in different relations. Because war was the chief business of the Romans, it was natural to ascribe to him the same love of slaughter. In *pl.* 15, *fig.* 13, we see a picture of *Mars Gradivus* (the Advancing), as he returns from battle with his lance, and the armor of a fallen enemy hung upon a pole, which he carried on his shoulder as a trophy of victory. The term *gradivus*, however, also and more properly characterizes him as repairing with rapid strides to the field of contest. As *Mars Ultor* (the Avenger) he appears (*pl.* 27, *fig.* 27) with the shield in front, and raised spear ready to be hurled against an adversary. Sometimes he was regarded, particularly after a battle, as *Mars Pacificus*, the bearer of peace (*pl.* 17, *fig.* 22). In this character he carries in the left hand an image of the goddess *Victoria*, and in the right an olive branch, both signs of peace acquired by war. The shield and lance are laid aside, and no armor appears except the helmet.

Like the other gods, Mars had numerous Genii in his service, three of whom are represented on *pl.* 18. The first (*fig.* 6) is carrying his sword resting in its scabbard, the second (*fig.* 7) his helmet, and the third (*fig.* 8) his shield. All three are winged, and wear wide open mantles.

The sons and constant attendants of Mars were *Pallor* (Dismay) and *Pavor* (Fear). The head of *Pallor* is given on a coin of Hostilius (*pl.* 30, *fig.* 30 *a* and *b*), with a war trumpet behind it. On the reverse stands *Diana*, with a radiant crown and a dress with straight folds; with her right hand she holds a stag by the horns, and in the left a spear. *Pavor*, on a denarius of the same time (*fig.* 31), is accompanied by a shield.

The sister of Mars was *Bellona*, the strangler and the desolator of cities, the goddess of war, and the driver of his battle-car during the conflict. It was her province to inflame the fury of soldiers, and to arouse their thirst for slaughter; and accordingly she was represented armed with shield and helmet (*pl.* 15, *fig.* 14.)

The most noted solemnity annually observed in honor of Mars was the *shield dance of the Salii* (*fig.* 25). It occurred on the 1st of March. The Salii were priests of Mars, twelve in number, whose chief was called *Præsul;* their principal musician, *Vates;* and he who inducted new members, *Magister*. In addition to these he had another priest of superior rank, with the title of *Flamen Martialis*, who was one of a class of priests of the first rank instituted by Numa. The Salii dressed in a variegated tunic, embroidered with scarlet, and a peaked cap or conical helmet. The whole ceremony originated thus: In the time of Numa, a brazen shield (*ancile*) fell down from heaven. The soothsayers pronounced it a pledge from Mars to the Romans, of his future favor and their consequent good fortune; and so long as the shield should remain in Rome, so long should they have success in war, and enjoy the sway of the world. That so valuable an object might not be lost, Numa ordered eleven similar shields to be made, and the whole twelve to be deposited in the *Sacrarium* of the Salii, whose duty it became as priests of Mars to guard them on the Palatine Hill. During the annual procession or dance, the Salii appeared in short tabards, with iron girdles and brass buckles, with iron helmets, a sword in

the right hand, and a shield in the left, and marched dancing through the streets of Rome, striking their swords incessantly upon their shields.

The *Martial Games*, which were celebrated annually, constituted the principal festival of Mars. Their features were a horse-race in the circus, and afterwards the sacrifice of a horse in Mars's field or *Campus Martius*. *Pl.* 28, *fig.* 27, represents the ceremony of this sacrifice. A magnificent statue of the god stands on a beautiful pedestal, before which is an altar on which the fire is burning. At the side of the altar are vases and sacrificial vessels, the officiating priest stands before it, and after offering a prescribed prayer, casts a laurel twig into the flames. Behind him is seen a youth crowned with laurel and playing martial music, and at his left is a boy with the sacred casket. Several other priests, adorned with wreaths and engaged in minor parts of the sacrifice, appear in connexion with armed men around the horse which is to be sacrificed. One man standing behind the statue of the god holds a laurel crown.

The name of our month March (*Martius*) was obviously derived from Mars, and being the first in the Roman year, is an evidence of the exalted rank which the Romans assigned to him.

5. Mercurius (Hermes), after the Romans began their commercial career, occupied a distinguished position in mythology. Generally the same functions were ascribed to him in Rome as in Greece, and as god of traffic he was highly honored by merchants. During a holiday appointed in honor of Mercury they marched in procession to his fountain at the *Porta Capena* in short tunics, and each carrying with him some of his articles of merchandise. Taking water from the fountain, and immersing in it a branch of laurel, they sprinkled themselves and their goods as an expiation for their lying and fraud in business.

In Rome alone Mercury had five temples. His festival occurred on the 15th of May, which is named after his mother, *Maia*. The representations of Mercury were exactly like those of Hermes, and we therefore refer to these, mentioning in addition a Roman statue representing him as a youth without any distinguishing marks (*pl.* 24, *fig.* 23).

6. Vulcanus (Hephæstos) was worshipped in Rome from the age of Romulus as the god of smiths. In the *Vulcanalia*, a festival in honor of him, it was customary to offer a boar, a red calf, and other red animals, and prayers were made for averting the dangers of fire. Wherever there were volcanic mountains or earthquakes, temples were erected to Vulcan and his worship was celebrated with great magnificence. He is represented like the Grecian Hephæstos, and the same myths are told of both.

7. Apollo, though at first regarded as simply the god of the bow and arrows, was very extensively and magnificently worshipped when the Romans began to develope a taste for the sciences. During the games of Apollo neat cattle and goats were sacrificed to him. The belief also prevailed that Apollo, as the deliverer from the curse, would undertake the redemption of the sinful world. His history and representation correspond with those of the Grecian Apollo.

8. Venus (Aphrodite) received the same distinctions among the Romans

as among the Greeks, being regarded as the ancestress of Romulus, the founder of Rome. She had seventeen temples in the city alone. The festival of *Venus Verticordia* (who turned the heart to love) was celebrated on the 1st of April, and on the 19th of August the gardeners solemnized the rural *Vinalia*, in which they besought from the fructifying goddess blessings for their crops of fruit.

Among the varied representations at Rome the *Venus Capitolina* (*pl.* 27, *fig.* 23) is remarkable. She has just risen from the bath, and is accordingly nude; her hair is tastefully arranged on the top of her head, a few locks only falling down on her neck. A large vessel stands near her, over which hangs a cloth edged with fringes. As goddess of love, which conquers gods and men, she was represented as *Venus Victrix.* On a coin (*fig.* 30) she appears leaning against a pillar, and holds in her right hand the helmet of Mars, while his shield stands at the foot of the pillar. On another coin (*pl.* 28, *fig.* 18) the shield marks her as *Venus Victrix.*

9. Diana (Artemis) had the same significance in Rome and Greece; but she was worshipped with far more splendor in the former, as goddess of the chase, of magic, and of the moon. A temple was erected to her on the Aventine Hill by Servius Tullius, and the 6th of April was annually celebrated as her birth-day. An inhuman custom obtained in conducting her worship in the Italian town Aricia. Her priest here was always a runaway slave, who could obtain his office only by killing his predecessor. The very same fate awaited himself, for there would always be slaves who would covet his place in order to escape the pursuit of their masters. In the yard or court of the temple there stood a tree, and it was a regulation that any one who broke off a twig was compelled to engage in mortal combat with the priest of Diana, who in addition to this was bound to fight a duel for life or death once each year.

In her representations, Diana was made more or less conspicuous according to the sphere she was supposed to fill; hence the variety in her pictures and statues. In *pl.* 15, *fig.* 10, we see but few of her peculiarities. The short tunic, with the still shorter cloak, serves to suggest the goddess of the chase, but she wants the buskins, the bow and the quiver. The veil which descends from her head over her back belongs to her as goddess of the moon, though generally the veil floats over her like a sail, and in that case she carries a torch or a figure of the moon. The figure may have been intended to represent her as the goddess of magic, or as *Lucina* (presiding over births), in which characters she had no special attributes. Sometimes she is represented with the insignia of various offices at once. Thus *pl.* 20, *fig.* 10, exhibits her as goddess of the chase, with the short tunic, bow, quiver, and buskins, and also with the inverted torch, which she rests on a stone, while she leans against another. The presence of the torch caused this statue to be designated as *Diana Lucifera*, and the other insignia as mere allusions to her other functions. A figure on a medal of the emperor Antoninus Pius (*pl.* 16, *fig.* 26) is by some taken for *Diana Lucifera;* but others interpret it as the portrait of the empress *Faustina* on horseback, adorned with the attributes of *Diana Lucifera*, the moon on the head and the torch.

10. Ceres (Demeter). The Romans had less sublime conceptions in regard to the worship of Ceres than the Greeks, and considered her as simply the goddess of seeds and harvests. Her service was conducted in Rome by priestesses (*pl.* 19, *fig.* 15) who wore as ornaments and marks of distinction a diadem, a long under-dress bordered with flowers, and a similar short cloak. They carried ears of wheat in their hands. The principal offering to Ceres consisted of fruits (*fig.* 16). The goddess is represented on wall-pictures found in Pompeii (*pl.* 24, *fig.* 3) in a long tunic, and an upper garment reaching to the knees. She holds a sceptre in her right hand, in her left a small basket with flowers or wheat-ears, and her head is adorned with a wreath. On a coin of Antoninus Pius (*pl.* 16, *fig.* 25), she appears in proper mythological relation with her daughter Proserpine under the appellation *Catagusa* (one who brings back, because she is returning Proserpine to Pluto). She carries the ears of corn, and embraces her daughter with the other arm. Proserpine has the pomegranate, the tasting of which for ever prevented her total release from the world of shades.

11. Minerva (Pallas Athene) was worshipped originally at Rome only as the goddess of war, but subsequently was ranked among the three chief female deities, and had a temple next to Jupiter and Juno near the Capitol. She appears on a coin (*pl.* 27, *fig.* 13) as the peace-bearer, the shield lying by her feet, and the lance standing on the ground.

12. Vesta (Hestia), whose veiled head we find on a denarius (*fig.* 6), enjoyed in Rome a remarkable celebrity. The sacred fire on her altar was never permitted to go out. Her priestesses were the *Vestal Virgins*, of whom we present one (*pl.* 30, *fig.* 5) with a sacrificial vessel and an olive branch in her hand; another (*pl.* 15, *fig.* 9) standing near an altar with fire; and a third (*pl.* 26, *fig.* 9 *b*) sitting on a chair and holding the sacred lamp. They were virgins selected from the most distinguished families, were devoted to celibacy, and had charge of the sacred fire. At the end of thirty years they could leave the temple and marry. If a vestal virgin suffered the fire to be extinguished she was scourged; if she violated her vow of chastity she was buried alive.

B. The Eight Inferior Gods.

1. Janus (*pl.* 15, *fig.* 2 *b*). His characteristics have already been alluded to in the system of the primitive gods to which he belonged.

2. Saturnus, in his capacity as god of husbandry, has been mentioned in the introduction. The further myths connected with his name are the same as those referring to the Grecian *Cronos*.

3. Genius was considered the deity holding supremacy over the genii that accompanied every man on his path through life. It is an indistinct deity, and was never the subject of artistical representation.

4. Sol, the god of the sun, corresponds entirely with the Grecian *Helios*.

5. Bacchus is identical with the Grecian *Dionysos*, and the festivals in his honor (*Bacchanalia*) were celebrated like those of the Grecian deity. One of the priests officiating at these festivals is represented in *pl.* 19, *fig.* 4.

6. Tellus, the deity of the earth, is the same as the Grecian *Gaia*, to which we refer.

7. PLUTO, the same as the Grecian *Hades*, had in Rome a subterranean temple, where sacrifices were offered to him and *Proserpine* (Persephone), of whom a curious Roman image is copied in *pl.* 16, *fig.* 3, which indicates her as the goddess of fruitfulness by the apples under her feet and in her hand, and the germ of a plant on her head.

8. LUNA, the goddess of the moon, corresponds with the Grecian *Selene.* A god of the name *Lunus* was also recognised by the Romans and sometimes identified with *Luna*, but he was properly the god of the *months.* His head is represented in a crescent (*pl.* 20, *fig.* 6).

2. THE GODS OF THE SECOND ORDER.

This class, known as the *Dii Minores* or *Dii minorum gentium*, comprehends all the remaining beings to whom limited divine honors were paid, or who were supposed to possess a species of divine nature.

A. Deities of the Social Feelings.

1. AMOR (Eros or Cupido) was the son of Venus and god of love. His history has been told in the Grecian mythology, and we here only add a few remarks relating to his connexion with Psyche. In *pl.* 29, *fig.* 7, we see Psyche, still in a state of suffering and probation, as Amor is tying her arms in order to chastise her. In *fig.* 8 he is scorching the butterfly, the symbol of Psyche, over a torch, thus signifying the purging of the soul by fire from corruption and sinfulness. *Fig.* 10 shows the reconciliation of the lovers. Psyche, adorned with bracelets and anklets, is drawing over herself a dress near a mirror; Amor presses her to his bosom; his bow and closed quiver are lying near by, and near his feet are a rose bush and scattered roses. The inscription may be rendered, "Sweet life! let us taste pleasure without bitterness! Live!" (*i. e.* enjoy life.) The last word is Greek written in Roman letters.

2. HYMEN is god of matrimony, uniting those whom Amor has brought together. He was represented (*pl.* 28, *fig.* 23) as a handsome youth, holding the wedding torch in one hand and a cup in the other.

3. The GRACES (*fig.* 21) stand in the attitude of persons who are returning thanks. The picture is borrowed from a group in which Mercury brings to Æsculapius, the god of medicine, a restored invalid who thanks him on his knees. The three Graces in this instance personify Gratitude, a play upon their name, *Gratiæ, i. e. thanks.* For the rest they hold the same rank as the Graces of the Greeks.

B. Deities of Happy Conditions and Virtues.

1. PAX, the goddess of peace, was variously described, though most commonly as a young woman with wings. In *pl.* 29, *fig.* 15, she is holding a herald's staff, as if inviting mankind to peace; while the serpent in front probably typifies the healing of the wounds received in war.

2. BONUS EVENTUS, or Happy Result, was originally a deity holding a

relation to harvest, and originated in the idea that the brightest *prospects* were useless without good *results*. Accordingly he was represented (*fig.* 19) as a youth, bearing in one hand ears of corn, in the other a sacrificial cup. At a later period the Romans applied this conception to the success of every desirable object, retaining, however, the original attributes of the god, as may be observed on a coin of Titus (*pl.* 16, *fig.* 24).

3. Concordia, goddess of harmony, appears on coins as a stately woman, sometimes standing though often sitting (*pl.* 29, *fig.* 18), and holding in one hand a cornucopia, in the other a sacrificial cup.

4. Fides, goddess of fidelity, holds in one hand a basket with fruits, in the other wheat-ears (*fig.* 14).

5. Pietas, goddess of piety, had various meanings and of course various representations. In the character of *piety* or *affection* for children she appears extending her mantle in a fond protecting manner over two children who stand near her (*fig.* 16).

6. Pudor, or Pudicitia, goddess of modesty, was represented as a maiden, seated and veiling her face (*fig.* 17).

7. Astræa, goddess of equity and justice, like *Justitia*, held in the one hand a cornucopia, in the other a balance (*fig.* 21).

8. Spes, goddess of hope, carries a blossom of the pomegranate tree in one hand, and gracefully adjusts her dress with the other (*fig.* 20).

9. Fortuna, the goddess of fortune, was variously represented. In *pl.* 19, *fig.* 8, she carries on her head a diadem and *modius* (measure), the latter indicating that she does not act blindly and capriciously, but distributes her favors knowingly and in accordance with merit. Her upper garment folds like a veil over her neck; with one hand she points to the earth, with the other towards heaven. She is far more simply clad in *pl.* 15, *fig.* 21 *b*. In *fig.* 21 *a*, however, she is represented with her principal attributes, the cornucopia and the rudder, but also with other insignia, viz. the thunderbolt of Jupiter, the serpent of Æsculapius, the bust of Isis and Serapis on the cornucopia, the nebris of Bacchus, the wings of Amor or Victoria, the torch of Ceres, the diadem of Juno, the rays of Helios, and in the highest point of the head-dress the lotus of Horus. The statue, therefore, cannot be regarded as a representation of the goddess of fortune alone, but as a combination of the chief attributes of all the deities. Such statues were called *Signa Panthea*.

10. Victoria (*pl.* 17, *fig.* 23), goddess of victory, corresponds completely with Nike of the Greeks.

C. Deities of Time.

1. The Horæ or Seasons (*pl.* 19, *fig.* 11) were represented as four children. *Spring* is carrying a flower basket, *Summer* a sickle, *Autumn* a fruit basket and rabbit, and *Winter* a rabbit and a branch of a tree for burning.

2. Aurora, goddess of the rosy morn (*pl.* 20, *fig.* 8), rides on a car drawn by four horses, preceded by Diana Lucifera bearing two torches. Above is seen the head of the bull. In *pl.* 26, *fig.* 10 *a*, we see her between her horses.

3. The Dioscuri (Castor and Pollux), whose history is given in the Grecian mythology, were represented by the Romans (*pl.* 20, *fig.* 4) adorned with laurel wreaths, beneath which the hair hangs in massive curls. Stars twinkle above them, and behind them we see two spear-heads pointing in opposite directions, a circumstance showing that the brothers are to take different paths.

D. River Gods.

1. Nilus. The Nile (*pl.* 21, *fig.* 15 *a*) is represented in the form of an old man reclining on a socle or low plinth, whose upper surface represents the waves. *Nilus* leans with one elbow on a sphinx and holds in his hand a cornucopia containing wheat-ears, grapes, wild roses, lotus flowers, the Egyptian *arum*, and a child with folded arms. The head of the god is crowned with the fruit and leaves of the lotus, and the right hand grasps a bunch of wheat-ears. Sixteen children sport over and around him, indicating that for the purpose of fertility the river must rise sixteen cubits. The genii at his feet are trying to bring on a fight between the ichneumon and the crocodile, others are covering the urn of the god with a heavy veil, to signify the obscurity of his sources or head waters. The two ends of the plinth (*fig.* 15 *b*) support plants and various Egyptian animals, as bulls, crocodiles, hippopotamuses, the ibis, and ichneumon, and two boats manned by natives of Tentyra, who are contending with a crocodile and hippopotamus.

2. Tibris (the *Tiber*) is also represented as an old man crowned with laurel and reclining upon his garments (*fig.* 16 *a*). In his right hand he holds a cornucopia containing clusters of grapes, flowers, vine leaves, and fruits, from between which projects a pineapple, and behind this a coulter as an emblem of agriculture. On his shoulder rests an oar, to show that the river is navigable. His left arm is placed on the wolf that suckled Romulus and Remus. The water rolls over a part of the plinth, and at the rough end may be seen a hill and wall of Rome. The ends of the plinth (*fig.* 16 *b*) show the Tiber as seen by Æneas. On the left is the sow that had the thirty pigs, and in the background the town of Alba. The god of the stream stands up to the middle in water; behind him is another figure, probably a god of another river emptying into the Tiber. The two who sit among the weeds on the bank are fishermen, one of whom has a basket on his knee; and further off is a loaded boat rowed by three sailors. On the lower part are two other boats, one of which is moved by the oar, while on the other a sailor is kindling a fire on the hearth, a second sits before his cabin, a third is engaged at the ladder, and three others are carrying goods for lading. A little further off appears a tree as a sign that the shore can supply wood, and near it we see several animals.

E. Gods of the Mountains, Forests, and Fields.

1. Faunus (*pl.* 16, *fig.* 1), the Grecian *Pan*, was represented with the tail, but without the horns and feet of a goat. In Roman mythology he was ranked with mountain and forest deities. In *pl.* 25, *fig.* 1, he appears

in company with a Bacchante dancing on a row of skins to the music of the reed flute.

2. Flora, goddess of flowers (*pl.* 26, *fig.* 9 *a*), is always represented with a crown of flowers or with a wreath of flowers in her hands (*pl.* 19, *figs.* 6, 7.)

3. Vertumnus (*pl.* 15, *fig.* 18) was honored as the god who, by the renewal of the year, brought back the fruits and blessings of which he was the harbinger. He is represented leaning against a stump, and holds a shepherd's crook and a sickle or garden knife, and in the skin suspended from his neck appear flowers and fruits. He wears a crown of fir cones.

4. Pomona, his wife, goddess of orchards (*fig.* 19), carries in one hand the fruit of a tree, in the other a flower stalk, while a basket filled with flowers hangs on a limb near by.

F. The Lares.

The Lares were patron gods of the house, the family, and even the community, city, or kingdom. Sometimes they were regarded as specific deities, though frequently other gods exercised the office of the Lares. Accordingly their representations varied (*pl.* 16, *figs.* 7, 8, 9). The domestic Lares appeared as youths dressed in dogs' skins and wearing a hat. They carried staves and were attended by a dog, the emblem of vigilance and fidelity.

In the later ages of Rome certain distinguished individuals received a species of worship. Among these we mention only *Antinous* (*pl.* 27, *fig.* 16). He was a handsome young man and the friend of the emperor Hadrian. During a voyage to Egypt he was drowned in the Nile, and the emperor erected a temple and ordained an annual feast to his memory, and placed his image among the constellations. After that his statues were common.

The Roman views of the condition of the soul after death corresponded mainly with those of the Greeks; though, of course, certain national peculiarities gave the whole subject a slight variation. There was no essential difference in the modes of worship. The Romans, it is true, had more temples than the Greeks, the city alone containing in its later days 424.

The worship consisted mainly of prayer, sacrifices, and feasts. Prophesying or divination also entered into the list of their religious customs and regulations. In addition to the sacrifices which we have already alluded to, we mention the *Suovetaurilia*, a sacrificial festival celebrated every fifth year in the Campus Martius (*pl.* 30, *fig.* 7), at the completion of the census, when, as an offering of atonement and purification, a hog, a sheep, and a bull, were publicly immolated. Before the sacrifice, the victims were led around the whole assembly, so that all might enjoy a share in the expiation. Besides this, the Romans had public sacrifices before and after expeditions of war (*pl.* 29, *fig.* 23), at which the bull was led to the altar in a solemn procession, followed by a long train of warriors. The vessels and instruments employed in making the offerings were mostly like those of the

Greeks, particularly the tripods on which they placed the flesh of the victim (*pl.* 30, *fig.* 8), the horn (*fig.* 9), the club or bludgeon (*pl.* 18, *fig.* 17), the axes (*figs.* 18, 19), the knives and forks (*figs.* 20–23), and the wand or staff (*fig.* 24.)

The priests and priestesses were divided into those who were engaged in the common service of the gods generally, and those who were devoted exclusively to the worship of particular gods. The former class embraced the *Pontifices*, whose number was sixteen, and who were selected from the first ranks of society. Their presiding officer was the *Pontifex Maximus* (*pl.* 30, *fig.* 1), who was appointed for life by the emperor. The latter class comprehended the *Flamines*, of whom the three most ancient and celebrated were those in the service of *Jupiter* (*fig.* 4), of *Mars*, and of *Quirinus*. Besides these, the sacrificial service required the aid of the *Victimarii* (*fig.* 6), men who had charge of the animals and other things necessary for performing the worship.

The *Augures* (*fig.* 2) constituted a college of priests, who divined and proclaimed the will of the gods, either by signs in the heavens, especially thunder and lightning, or by observing the flight, song, and the cries of birds, or their manner of feeding. For the latter purpose chickens were kept at the cost of the government, and fed by a special attendant (*pl.* 16, *fig.* 34). Whenever it was desirable to consult them they were fed, and the Augurs carefully observed whether they ate eagerly or not, and upon this and other manifestations they founded their predictions.

The *Sibylline Books* were preserved by the *Quindecimviri*, fifteen men (*pl.* 30, *fig.* 3) selected for that purpose, and whose office it was to consult the mystic pages, and prescribe the proper religious services whenever the state was in danger. These ominous books of oracles were brought to Rome by *Sibylla*, a renowned soothsayer (whose supposed image we have copied in *pl.* 17, *fig.* 27), and offered to Tarquinius Priscus for a very great price, as containing divine revelations which would protect the state in the hour of danger. The books were nine in number. Tarquinius deeming the price demanded exorbitant, refused to buy them. Sibylla then left him, and after a period returned with six of the books, having burned three. For the remaining six she asked the same sum as before. When the king again refused the price she threw three more into the fire, and still persisted in asking the same price for the remaining ones. Struck by such a proceeding the king called a council of eminent men, who advised him to buy the remaining books for the benefit of the state, since it appeared that their contents were so precious that every part of them was worth the price of the whole. The books were then purchased, and kept in the temple of Jupiter, their oracles being interpreted for the benefit of the state by their keepers. According to Cicero, they were fabricated by a number of wise statesmen and priests, who employed Sibylla to effect their adoption, having couched the oracles in ambiguous language, and managed to reserve the office of interpreting them to a number of men selected from among themselves and their descendants, thus securing for ages an enormous influence on all important affairs of state to their own families.

Having now completed our outline of the various systems of religion which recognise a number of deities, we propose to close the subject with a brief notice of Monotheism.

MONOTHEISM.

Monotheism comprises the religious systems which are based upon the belief in One God. According to the Bible, monotheism was the primitive religion of the human race, though its form was remarkably simple, and in accordance with the child-like disposition of the earliest members of the human family. A careful examination of the traditions and religious systems of the ancient nations, who, as we have pointed out in various places, nearly all had an indistinct idea of one supreme being above all the other deities which they worshipped, must lead to the conclusion that the fundamental feeling of man at all times must have pointed to the existence of one creator and ruler, and that the recognition of other deities must have arisen from the desire to comprehend the influence of the Supreme Being on the course of events and the universal life of nature. We cannot here enlarge upon the probable way in which Monotheism was gradually lost in the labyrinth of Polytheism, but proceed to give a brief account of the three forms in which it again made its appearance, dispelling the obscurity of Paganism.

1. The Mosaic Religion.

Moses, the celebrated Jewish Lawgiver, in endeavoring to liberate his people from Egyptian idolatry, and to establish them in the belief of one God, placed in the very front of his teachings this precept: "Jehovah is the Creator and only Lord of Heaven and Earth, and there is no other god beside him. Ye shall not make unto yourselves any graven image or likeness of God." The Pentateuch also describes Jehovah as an invisible *king* of his people, whom he chose to govern through the medium of the priesthood. Accordingly all the laws, or ordinances and regulations, whether moral, religious, or civil, claimed for themselves divine authority; and as they contained a stringent statute prohibiting the intermingling, by marriage or otherwise, of the Israelites and the surrounding heathen, the government took the form of an exclusive theocracy. The Hebrew commonwealth thus constituted, subsisted under various modifications nearly 1600 years. Its practical effects corresponded with its intrinsic character. While in many respects it operated beneficially, preserving the doctrine of the divine unity, and binding the Jews firmly to their nationality, it continued a barrier between its professors and those of other creeds, and finally degenerated to a lifeless round of ceremonies.

2. Christianity.

Christianity, while it rested in a considerable measure upon the faith and morals revealed in the old Testament, was justly described by one of its earliest preachers as a nobler branch grafted upon a wild tree. The God of Christianity is not the strong and jealous God that governs and punishes without mercy; but a tender Father who commiserates the sinner, and seeks by kindness and mercy to win him to holiness and salvation. His children, accordingly, are not selected exclusively from any one tribe; "but in every nation, he that feareth God and worketh righteousness is accepted of Him." Every one, however humble, receives his notice and protection, and nothing can befall him without the will of his heavenly Father, who can compel all events, whether prosperous or adverse, to work out for his good. While all men are thus God's children, they are expected to love each other as such; and the blessed Founder of Christianity has promised to recognise as his followers only "such as love one another."

Professed Christians have often sadly departed from this standard of discipleship. They have hated, persecuted, and murdered their brethren for opinion's sake; and in the course of time so many parties have arisen in the church, that were it not for the positive promise of God one might well despair of ever beholding that desirable object, "One fold and one Shepherd." Every denomination seems to suppose that it alone possesses the true faith and has found the way of salvation, forgetting all the while that "*love* is the fulfilling of the law," and is thus superior to faith and all other qualifications.

The oldest of these divisions is known as the *Roman Catholic Church.* At the head of its organization it recognises the Pope as God's representative; besides God and Christ it venerates the Saints; professes to hold the all-saving faith; condemns all who maintain a different belief; withholds from the laity the Bible, the original source of all certain knowledge in regard to the proper doctrines of Christianity; and in many cases openly contradicts the clear expressions of Holy Writ.

The *Greek Catholic Church* forms a second of these branches. It differs from that just described mainly in refusing to recognise the bishop of Rome as the sovereign Pontiff of the Christian church.

The *Protestants* compose a third party, which is again broken into numerous smaller sects, as the *Reformed*, the *Old Lutheran*, the *United* (*Evangelical*) churches of the European continent; the *Anglican* or *Episcopalian*, the *Presbyterian*, the *Independent*, &c., of England; and the *Lutherans*, *Episcopalians*, *Methodists*, *Presbyterians*, &c. &c., in the United States. Indeed so great has been the tendency towards dissent and party spirit, that the earnest labors of those pure, noble, and elevated minds which have always striven to unite men in the rational affectionate "worship of God in spirit and in truth," have hitherto proved unsuccessful.

3. Mahomedanism.

Mahomedanism, the most widely spread monotheistic system of religion, was established by *Mahomed* (or *Mohamed*) in the year 622, A. D. It is a compound of Jewish, Christian, and to some extent Heathen religious ideas and rites. Its founder proclaimed himself as the greatest prophet and the most distinguished ambassador of God; denounced as infidels all who refused to profess his religion, and ordered them to be persecuted with fire and sword. Unlike Jesus Christ, who invited men to test his religion, and left its adoption or rejection to the free exercise of their understanding, Mahomed propagated his system by arms.

Mahomedanism differs from Christianity in two important particulars: it teaches an unchangeable predestination, and holds out the promise of a sensual Paradise. This heaven is promised particularly to such as fall in doing battle for their religion; and in order to increase as rapidly as possible the number of believers, the condition of the blessed is described in language far more glowing, voluptuous, and extravagant, than any we have employed in treating of the northern mythologies. Groves, rivers, fountains, diamonds, pearls, and marble palaces, delight at once the eye and the feelings; costly dishes served in golden vessels and wine in princely cups regale the taste; the most delicious perfumes impregnate the air; seventy-two dark-eyed virgins of graceful form and blooming youthfulness (*Houris*) receive the believer and minister to his endless felicity; and seventy thousand slaves stand always waiting to fulfil his wishes, even before they are uttered. In direct contrast to all this pleasure, Mahomed has painted hell as a place where transgressors, apostates, and infidels are punished with intolerable torment, the measure and nature of which are determined by the grades of offence during life. Faith in the Prophet, however, inducing his intercession in their behalf, can save from this punishment the most guilty and abandoned sinners.

The ethical teachings of Mahomed are simple, and his theological doctrines, borrowed from Christianity, are in part conveyed in a dignified and attractive form. Among the sacred duties of the faithful are *daily prayer*, during the offering of which the face must be directed towards Mecca, and not as formerly towards Jerusalem; *a fast of thirty days* in the month of Ramadan, the ninth of the Turkish year; the devotion of at least a tenth part of their income to charitable purposes; and certain prescribed ablutions and purifications of the body. Monachism and ascetic penances, the veneration of images, and indulgence in wine, are expressly prohibited.

The religion of Mahomed is sometimes called *Islamism*, and its professors *Moslems* or *Mussulmans*. The *Coran* or *Alcoran* is the rule of faith, the substance of which is considered eternal and uncreated; and Mahomed, who pretended to have received it leaf by leaf from the archangel Gabriel, regarded himself only as the editor. The contents of the Coran were embosomed from eternity in the divine mind alone, and written in rays of light upon the tables of his unchangeable counsel, until the archangel Gabriel

communicated the revelation to Mahomed. Accordingly the Coran is a collection of numberless miracles; indeed every verse contains a wonder. At a later period, the *Sunna*, embodying oral precepts and traditions, was added to the Coran, but its introduction gave rise to two hostile religious parties, the *Sunnites* who receive the Sunna, among whom are the Turks; and the *Schiites*, who reject the Sunna as apocryphal. The Persians belong to the latter sect.

The *Caaba*, or national temple of the Mahomedans, erected at Mecca, is an object of the highest veneration, and every faithful believer is expected to perform at least one pilgrimage to its sacred shrine. The priests are called *Imaums*, and though, as above remarked, monachism is prohibited, there is, besides the priests proper, a kind of monks known by the name of *Dervises*, who, however, may be considered as travelling priests or missionaries.

Of the many marvellous exploits which the disciples of the prophet are fond of attributing to him, none can exceed in extravagance his wonderful night journey to the seventh heaven. Mounted upon a resplendent steed *Al Borak* (the lightning), he first rode out of the temple of Mecca to Jerusalem. Thence he ascended through measureless space, in company with the archangel Gabriel, to the seventh heaven, where he was saluted by patriarchs, prophets, and angels. Beyond this he beheld the throne of *Allah* himself, whose face was covered with twenty thousand veils (for no man could have looked on his undimmed glory and live) and was touched by the Almighty, who placed his hand upon his shoulder, which caused a freezing cold to run through the very marrow of his bones. After receiving several communications from Allah he descended by the ladder of light to Jerusalem, where he found Al Borak fastened as he had left him. He mounted the saddle, and returned to Mecca, having accomplished in a few hours a journey which would have required an ordinary traveller many thousand years.

THE FINE ARTS.

PLATES IX. 1–26.

ART is the flower of civilization, the ornament of life. Although the artistic instinct may be said to be innate in man, although the feeling for the beautiful is deeply implanted in our nature, still it does not come forth to light until the requirements of the body have been satisfied; for want gives the death-blow to art, which can only attain its full development when the mind is free from care. So long as nations are occupied in securing their material well-being, we find among them only those rude forms which seem sufficient to meet the immediate demands of security and comfort; and it is not till a later period that we find the sense of the beautiful making its existence practically manifest, by joining the agreeable to the useful, and the ornamental to the necessary.

Art rises with the mental cultivation of a people; and in its productions the character, disposition, and degree of civilization of a people are accurately reflected. An effeminate sensual people are strangers to vigorous forms in their works of art; and with the decline of scientific cultivation, art also declines.

Before proceeding to perform the task we have undertaken in this treatise, that of giving a brief history of the Fine Arts in all times and among the principal nations of the earth, we must premise a few words on the meaning of the term *art*, and the accessory notions connected therewith.

By the term *art* in general, we understand that species of activity whereby something internal and spiritual is brought forth into the visible world, or in other words the power of representation. The essence of art then, as such, consists in this, that its design is only to *represent;* and thereby it distinguishes itself from all other, viz. from practical pursuits, which are constantly directed to the attainment of some end in external life. This, too, is what distinguishes art from a trade or handicraft. A handicraft sets an object before us as practically useful; art adorns it and renders it more agreeable to the eye.

The external object or object to be represented in art is a sensible form, whether created by the fancy or borrowed from external nature. But as even corporeal seeing, and in a far higher degree mental, artistic seeing, is an operation of the fancy, we must regard the latter as the principal condition of artistic representation. Thus the painter properly paints with his

eyes; and his art is, to see regularly and beautifully. To creation, or the power of seeing, must be joined as a subordinate one the power of representing the form in a material, that of execution.

That which is represented, the mental conception, whose expression is what properly constitutes an artistic form, we call a work of art. It is an idea of a particular sort which at the same time is combined with a powerful and lively feeling of the soul; so that sometimes both idea and feeling are united in a spiritual condition, while at others the idea becomes more prominent, although in the adoption of the form properly so called the feeling always predominates.

By the laws of art we mean nothing more than the conditions under which the faculty of feeling of the human soul can be excited to beneficial action by means of external impressions; and they determine the artistic form, in accordance with the demands of the feelings. But first of all the artistic form must possess a general regularity, which results from the observance of mathematical relations or of organic forms of life, and institutes the limits within which the artistic forms move. This, for instance, in statuary, is the relation borne by the organic fundamental forms to the particular plastic figure.

After regularity, beauty is the next requisite of the artistic form in reference to the feelings; and we call *beautiful* those forms which cause the soul to feel in a manner which is truly beneficial and salutary, and entirely suited to its nature; in other words, which make it vibrate naturally. The highest beauty stands in opposition to the endeavor to represent something peculiar; wherefore Winckelmann says, that perfect beauty must be as void of peculiarity as the purest water.

The two extreme points in the chain of sensations are the sublime and the pleasing. The former requires of the soul an energy raised to its utmost limits; while the latter, without any stirring up of its powers, draws the soul of itself into a circle of salutary sensations. Moreover every work of art must possess a unity to which everything in it bears reference, and by virtue of which its various parts are so held together, that the one as it were demands and renders necessary the other.

The divisions of art are founded on the nature of the form under which its representations are produced. All forms that possess a certain regularity are adapted to the purposes of art, particularly *mathematical* forms, on which the nature of bodies and of their systems depends, and *organic* forms, in which life on our earth attains to a wider and higher development. The more obscure and undeveloped the idea to be embodied in a work of art, the better adapted for the purpose are mathematical forms; but the clearer the idea, the more recourse is had to the forms of organized nature for its expression.

Every form presupposes magnitude, and it is in the nature of this magnitude that each several art originates. If the magnitude be one of time, we then have music and eloquence; for tone is ever a magnitude of time. To these arts, taken in a wide sense, belong also Orchestrics or the art of dancing, which to time adds space, and to the extent of the motion the manner

in which it is performed; for man can effect a representation in space and time only by the motion of his own body. The arts which represent in space alone, those of design, make use either of geometric or of organic forms.

Geometric forms may certainly be the object of art properly so called, since they may be elaborated according to the rules of art, and thus are produced utensils, vessels, dwellings, and places of assembly. This branch of the fine arts is called Tectonics, and its highest grade of development Architectonics; its peculiar character results from adaptedness to a purpose combined with artistic representation. But those arts which have to do with organic forms, are essentially imitative and are based on studies of nature. They are: 1, Plastics or Sculpture, by which the forms themselves are presented corporeally; and, 2, Design or Graphics, which present on a surface, by the use of light and shade, a semblance of corporeal forms. The aid of color may be resorted to in both these arts; but in plastics its use becomes less advantageous as there is an endeavor to imitate nature, and under such circumstances the want of actual life makes itself so much the more sensibly and unpleasantly felt. This too is the reason of the unfavorable and almost repulsive effect produced on most persons by a collection of wax figures. When color is combined with graphics, it raises this art to the dignity of Painting. As sound arises from vibrations of the air, so color, according to Euler, is produced by vibrations of the luminous æther, and consequently has in its effects and laws a strong resemblance to sound. While sculpture exhibits all organic forms with the utmost completeness, leaving nothing undefined, painting contents itself with the effects of light and mere appearance; but on the other hand it can make use of a far greater number of forms than sculpture, which in this respect is tolerably limited. Bas-relief forms a connecting link between sculpture and painting. The ancients treat it more in the manner of sculpture, the moderns more in that of painting.

The pursuit and practice of art is either national or individual, according as it results from the mental activity of an entire people or of a single person, and is characterized by the peculiar habits and idiosyncrasy of such people or person. This character we call *style;* and as there is an Egyptian or Grecian style, so too there is a style of Phidias or Praxiteles when the idiosyncrasy of the individual artist is powerful enough to characterize his entire productions. *Manner*, on the contrary, is a vicious intermixture of the personal with the artistic, arising either from habit or from a morbid tendency of the feelings, in consequence of which the form, without regard to the requirements of the subject, is constantly modified in a similar manner.

Art stands everywhere in a special connexion with religious life, with the ideas entertained of the Deity; inasmuch as religion opens to mankind a spiritual world which, although it does not appear externally, yet requires an external representation, which is found for it under one shape or another in art; and a religion is found to be artistic and plastic in proportion as its ideas are susceptible of representation in the forms of the organic world.

If art is compelled first to search out or invent forms for the representation of the Deity, it takes a mystical direction, as for instance was the case with the animal symbols of the Grecian divinities, and then he alone whose mind is penetrated with the special feeling and belief can discern the divine life in the animal.

As architecture has been handled sufficiently at length in another Division of this work, the subjects which remain for us to treat of here are Plastics or Sculpture, Painting, and Music. Each of these we will take up separately, combining our remarks on the art itself with the history of the same.

I. SCULPTURE, OR THE PLASTIC ART.

The art of representing the objects of organic nature in all sorts of materials, as clay, stone, metal, wax, &c., in such a manner as to be perceived by the sense of feeling, is called *sculpture*, or, as mallet and chisel are not always used in it, the *plastic art;* and to this is always reckoned by way of exception that part of tectonics which relates to the artistic arrangement of the various articles of furniture, as vases, &c.

Sculpture either represents its objects full-rounded, in all their proportions, so as to be viewed from every side, and then it furnishes the truest copy of nature, or else it presents a half-rounded image, which projects only by a portion of its thickness, either half of it (*bas-relief*), or somewhat more than half (*haut-relief*), from the plane surface which both serves as a background, and cements the figures together. We have already remarked that relief forms the connecting link between sculpture and painting. A detail of the processes by which the art of sculpture is carried into practical execution would be out of place here. We will only state that the artist first prepares a model on a reduced scale of the object to be represented, and this he transfers to the block by gradually removing the superfluous parts until the finest details are brought out.

We will now consider the art of sculpture as it has been practised by different nations and at different times.

1. Non-Classic Antiquity.

We reckon as belonging to the nations of non-classic antiquity all those whose civilization and mental culture are older than those of the Greeks and Romans; and consequently, with but few exceptions, those primitive nations of whose mental cultivation it is true we possess relics, but whose writings have either wholly or for the most part perished.

A. The Hindoos.

The people among whom we find the earliest traces of mental cultivation are the natives of India, the easternmost branch of the Caucasian race; and

that they are gifted with great powers of mind is evinced by their possession of a highly elaborated language, a religious system skilfully wrought out, and poetry teeming with imagination and fancy. Still they were not fitted for the successful cultivation of the plastic art in an original manner. The quiet contemplative spirit of ancient and the luxurious fancy of later times found in the existing forms of nature no expression for the shapes to which imagination gave birth; and hence we meet among them with only supernatural and chimerical images of deities. And although our wonder is excited at the perseverance of Indian artificers in excavating their grotto temples, and in hewing out entire mountains, still we miss that guiding spirit which might have regulated and used such great industry and such an enormous expenditure of power to the attainment of magnificent results. We have had occasion in an earlier part of this work to express our sentiments in full with respect to Hindoo architecture; but in the sculptures of India, i. e. in the high and low reliefs which adorn the walls of the rock temples, and which, in addition to their images of the gods, also represent scenes from the heroic and legendary ages, we miss both the guiding spirit and that strictness of system which characterize an art that has long been cultivated on a native basis. Hence while the Indian sculptures surpass those of Egypt, of which we shall soon speak, in naturalness of position and freedom of movement, they must yield to the latter in strictness of drawing and the regular disposition of the figures. In the expression of characteristic distinctions of the bodily form of the different personages little seems to have been accomplished, as appears for instance from the relief on the façade of the sanctuary in the grotto temple at Kenneri (*pl.* 1, *fig.* 4); and everywhere the attributes are represented by the dress, the coloring, or by monstrous appendages. The greatest amount of skill is shown in the representation of female figures, as *e. g.* the image of Lakshmi from the pagoda of Bangalore (*pl.* 2, *fig.* 14), and another from the grotto temple of Rama in Isura (*fig.* 15). Nevertheless in the accumulation of attributes, the combination of figures with many limbs, as *e. g.* in the Trimurti on the bas-relief in the grotto temple of Elephanta (*pl.* 1, *fig.* 2) and the relief from the grotto temple of Wisua Karmah at Ellora (*fig.* 3), the constrained postures, and the striving after ornament (see the head-dress of the Trimurti, *fig.* 2), the art of ancient India, as exhibited in the rock-hewn temples, is on the whole very moderate, when compared with the monstrosities of many modern Indian idols and paintings.

B. The Medes and Persians.

The architecture of the Medes and Persians has already been discussed in its appropriate place. Of the remains of their sculpture but little has hitherto been known; but great light has been thrown on their progress in this art by the recent explorations in Nineveh. Most of the plastic monuments discovered are reliefs, in which the principal figure is usually a king or a hero (see the relief from the ruins of Persepolis, *pl.* 1, *fig.* 1), who is clothed in a richly embroidered tunic, with an upper garment and a tiara, and usually followed by two figures similarly dressed; or who is represented

fighting, seated at table, holding his court, &c. Frequently too he appears holding a staff as a sceptre, and with a retinue of canopy-bearers and eunuchs behind him (*pl.* 2, *fig.* 18). In battle a figure, probably a guardian deity, frequently stands behind him holding a defensive weapon over his head (*fig.* 19), or he is followed simply by a shield-bearer (*fig.* 17) with a peculiar head-dress (*fig.* 16). Female figures are rarely seen, but often those of animals, as lions, horses, and bulls, the latter also with human faces. Several reliefs represent sieges, fortresses, &c. The skill shown in the drawing of the bodies, the delineation of the hair, &c., is highly praised.

The ruins of Persepolis, from which the above cited reliefs are taken, exhibit a great quantity of architecture adorned with sculptures. Strange symbolical forms of beasts executed in high relief stand as royal insignia at the entrances; and similar ones are frequently made use of for architectonic purposes. Among the principal figures are the unicorn with and without wings and an enigmatical beast with a royal head-dress, also the griffin and the lion. Groups in which a mythological hero vanquishes a monster of this kind are frequently represented in relief. Very remarkable are the reliefs on the grand stairway in the ruins of Persepolis, where the provinces of the kingdom are represented bringing the yearly presents to the king. The costumes are characteristic. The noblest, that worn by the king himself, is the Median dress, the stola of the Magians. To the ordinary belongs the coat with empty sleeves, the Persian *kandys*, resembling the Hungarian pelisse. Among head-dresses are the tiara with side-ribands, such as is worn by the king (*fig.* 19), the *kidaris*, and the *kyrbasia* (*fig.* 17). A peculiar covering for the head is represented in the Numidian half-bust (*fig.* 13).

The circle of the plastic arts with respect to mythology is among the Persians very limited, and we find only the image of Ormuzd, a half-figure hovering in the air and ending below in wings, together with the symbolical animal; all else belongs to historical representation. Strict propriety demands everywhere careful clothing and majestic movement, which even in combat with monsters is not disturbed; to the same reason is to be attributed the entire absence of female figures. The folds of the garments are regular throughout, and the hair is very carefully treated. The drawing is executed with firmness and precision; the features bear a dignified impress, together with the stamp of nationality; the postures and gestures present a pleasing variety, and even the figures of animals are grandly and vigorously sketched. The work in the very hard stone is everywhere neatly executed, and the treatment of the reliefs is peculiar. Although Grecian artists worked for the Persians (Pliny names *e. g.* Telephanes), still in everything there is manifested a native style of art the result of centuries of cultivation.

C. The Babylonians and Phœnicians.

The Babylonians, early brought together under monarchies and favored by the protected situation of their low-lying river-land, began at a very remote period to erect buildings of importance; and this of course was accompanied by the cultivation of the plastic arts, although sculpture

properly so called never attained a very high point of excellence among them. We meet most frequently with reliefs which were impressed in the clay before it was burnt and then coated with various colored varnish, and also statues of deities made of wood and plated with gold or silver. Works regularly sculptured in stone are hardly ever found, as the material had to be brought from a great distance, and even wood, excepting that of the palm-tree, was scarce. The statues of the gods, however, were made of a colossal size; for Herodotus mentions the image of Belus which cost 800 talents of gold, and another image 24 feet in height. Diodorus informs us that they made brazen statues of their kings. Daniel, too, set up stone images; but these belong to a later period, and probably were also of burnt clay.

Still many engraved stones are found which were executed by the Babylonians; and Herodotus says that every Babylonian had his signet. These stones are cylinders of chalcedony, hematite, agate, &c., and the figures engraved on them are for the most part representations of the principal gods of the Babylonish religion. The style of these productions is very various, but mostly resembles the Persian.

The Phœnicians thought less of indestructible than of ornamental works of art; their temples were usually very rude, and the wooden walls were very often plated with gold. Sculptured work among them attained to no great excellence, and statues of stone were very rare. Nor can cast statues be shown to have existed among the Phœnicians, although they were not unacquainted with the art of brass-founding, since they cast vessels of elegant and frequently of colossal form. Of the sculptures of the Phœnicians little or nothing has come down to us; but we know, from their coins and engraved stones and from the accounts of the ancients, that the figures of their gods by no means exhibited those characteristic and significant traits which indicate an indigenous school of art. Some gravestones there are, as those in *pl.* 2, *figs.* 11, 12, which show as little artistic skill as they do originality of invention. In their figurative representations the Phœnicians often employed combinations of the human form with those of animals, while by means of dwarf-like or shapeless and strangely designed figures they strove to express the mysterious nature of the deity.

D. The Egyptians.

The Egyptians form a distinct branch of the Caucasian race of mankind, elegant and slender in form, and fitted for persevering labor. We find them in the earliest times through the whole extent of the valley of the Nile; and as the country has a peculiar, secluded, and uniform character, so we find the people to have led from a most remote epoch a monotonously regulated and, as it were, petrified life. Their religion had become a very complicated ceremonial worship. The hierarchy and the system of castes made their influence felt in every department of human activity, and each employment was carried on by people who were born to it. We find among the Egyptians the art of writing already in use and brought to great perfection; it consisted first of a monumental writing, the hieroglyphics,

some of which have a phonetic value; then the hieratic writing, which appears to have arisen through an abbreviation of the hieroglyphics in transferring them to paper; and the demotic, which is still further simplified, and approaches nearest to the nature of alphabetical writing. This last was used for legal documents, letters, and all the purposes of ordinary life. Through the knowledge obtained in recent times of these species of writing, and especially of the hieroglyphics, we have been able to determine the age of many monuments, which, as Egyptian art remained unchanged for thousands of years, could hardly been done from their style.

In Egyptian art the following periods are to be distinguished: 1, before the Syro-Arabian invasion of the Shepherd kings, sixteen dynasties; at the end of which nothing escaped destruction but the pyramids of Memphis, a work of the fourth dynasty. Here fragments of temples are found built in, which show exactly the same style as the later buildings. 2. The period of the native princes, who, starting from the southern border of the kingdom, gradually regained possession of it, and whose glory under Rhamses the Great, Sesostris (1472 B. C.), &c., reached its greatest height. The names Rhamses, Sesostris, Amenophis, Thutmosis, all belonging to the eighteenth dynasty, are found on numberless monuments, and also in Lower Nubia. Thebes was then in the height of its splendor. 3. Egypt under foreign dominion, first Persian, then Greek, and lastly Roman; which, however, produced no essential change in the manners and customs in the interior of the country. It was reserved for Christianity with its direct assaults to break up this mummy-like, dried up, and therefore imperishable Egyptian world.

With respect to locality, the monuments and productions of Egyptian art may be divided into: 1. The Upper Nubian. Here was Meroe, where the dominion of the priesthood survived the longest (270 B. C.). Here are still found considerable ruins and remains of art, but which exhibit the Egyptian style only in its later degenerate stage. 2. The Lower Nubian, which show an affinity to those of Upper Egypt. They are mostly in the form of excavated structures, the Nile Valley being in this portion too narrow to admit of large foundations. According to the hieroglyphic inscriptions, they date from the flourishing period of Thebes; and their for the most part unfinished condition shows that they belong to a transition period. A specimen of such grotto-like constructions is found in the temple of Hathor at Ipsambul (*pl.* 2, *fig.* 10). This is the smaller of two monuments, the larger of which is almost wholly buried in the sand. The one here represented is free from sand, and is situated close to the Nile. Before it stand six colossi about 50 feet high, three on each side; in each group the outer figures represent priests and the middle one a priestess. The interior has a statue placed in a niche. The walls are adorned with painted bas-reliefs. Some scholars assert that these two monuments are not temples, but royal tombs or cenotaphs, perhaps for Rhamses the Great. 3. The Upper Egyptian, comprising those of the region above Thebes and of Thebes itself; all of which date from the 18th and 19th dynasties, and together exhibit one and the

same powerful and grandiose style. 4. The Middle and Lower Egyptian have been mostly destroyed, partly during the frequent civil wars, and partly in consequence of the rise of new and large cities in their neighborhood. In the Oases also there are found some ancient remains, *e. g.* a temple of Ammon, the royal citadel, catacombs, &c.

The Egyptians particularly excelled in sculpturing stone; and since the art of sculpture appeared ever among them as the handmaid of architecture, and as the adorner of the works of the latter, it bears, so to speak, a thoroughly architectonic character. Their statues, made for the most part of the hardest species of stone, *e. g.* granite, syenite, porphyry, basanite, or hard fine-grained sandstone, and the smaller ones of hematite, serpentine, or alabaster, are mostly intended to rest in a standing or sitting posture against pylons, columns, and pillars; for figures standing alone are very rare. They are designed and executed with masterly precision. In the sitting figures (*pl.* 2, *fig.* 7) there reign the greatest repose and equilibrium of attitude; the treatment of the standing figures is stiff, and they rarely have much action. The feet are often placed close together (see *figs.* 1, 2, and 3, from the Capitoline Museum in Rome), the arms are occasionally somewhat elevated. Free and moving postures (like *fig.* 6) seldom occur. Sometimes the figures place one foot forward, as if to advance (*figs.* 4 and 5 from the British Museum), but without altering the rigid posture of the body. The principal type of the Egyptian standing figures is represented in *fig.* 4. The size is often very colossal; for figures are found of from 53 to 60 feet in height, for the transportation of which great multitudes of men were required, as is seen in a relief at Thebes, where a sitting statue is represented in the act of being removed. The forms of these statues are for the most part correct, and by the simple curves of their outlines produce an imposing effect; but their great approximation to geometrical forms produces a want of life and warmth in the conception of the details. The parts of the body are formed after the material type, although based on certain rules of proportion. The forms of the sexes are well distinguished; but a definite character is nowhere exhibited in the images of the gods and kings; they are distinguished only by their attributes and dress, viz. by various head-dresses, and by having the heads of animals, birds, &c., as is shown in the plates to the Egyptian mythology, in another division of this work.

The forms of animals exhibit much more spirit and depth of observation than those of men, a study of nature which displays itself even in their religion. The blending together of the forms of several animals is often very happily executed, though sometimes the effect is rather odd. Rams occur most frequently (*fig.* 8) though generally with a lion's claws and tail; also lions, jackals, different kinds of apes, the ibis, and sphinxes. Andro-sphinxes (*fig.* 9) are lions with human heads; the largest is that near the pyramids of Gizeh (see Plates Division VII., *pl.* 6, *fig.* 6), which is 117 feet in length and 40 feet high, hewn out of the living rock, and had in its breast between its paws the entrance to the great pyramid. Other composite forms of animals consist of the lion and hawk, the lion and uræus with

wings, the serpent and vulture, &c. We find here exhibited the striking contrast, that the Egyptians in their combinations most willingly sacrifice the head of the human figure, whereas the Greeks in the same case constantly retain the head: we will instance only the syrens and similar combinations.

The reliefs of the Egyptians are not as successful as their figures; for it is obvious that their artists strove to represent every member of the body as complete as possible. Hence in Egyptian reliefs we often have in the same figure a side view of the head, a front view of the breast, and a side view of the haunches and legs. A front view of the face seldom occurs, in religious reliefs never. In representations connected with religious worship a constant type for the positions was soon established, which perpetually recurs. The action is freer in representations of domestic life and the like; the most awkward are those of battle-scenes, and in general where the subject demands figures on various levels and consequently a perspective arrangement. The Egyptian reliefs seldom project from the level surface of the wall but mostly from fields which have been hollowed out (koilanaglyphs, *reliefs en creux*).

In addition to the works of sculpture, we must here also mention, as a department of Egyptian art, their works in burnt clay. These exhibit many excellent productions, consisting partly of vessels, to which the so-called canopuses belong, and partly of small figures coated with a colored enamel and mostly very well designed. So too the well known scarabæi, amulets worn on a string round the neck, and which are very often found between the bandages of mummies, frequently consist of burnt clay, although many are of carved stones (amethyst, jasper, lapis lazuli, &c.). Sculptures in metal are rare; on the other hand the Egyptians were able to carve beautifully in wood, although of this latter material there was no great abundance. The sarcophagi of the mummies exhibit many specimens of these branches of art.

If in conclusion we take a retrospective glance at the objects chiefly represented, and the manner of their representation, we find that the Egyptians were wholly destitute of the impulse to represent that which fills and moves the soul *because* it is beautiful; on the contrary, all their representations, excepting the figures of their gods, are purely historical, are as it were memories carved in stone, on which account even their sculpture is for the most part accompanied by hieroglyphic inscriptions. The gods never appear in action, but all the reliefs relate exclusively to their worship. To the kings the artists have given as far as possible a portrait likeness; and in the battle scenes the closest accuracy is observed, which extends even to the number of the enemy slain and captured, as is also the case with the game in hunting and fishing scenes. In the representations of domestic employments which are often met with in the tombs, respect is always had to the occupations in which the deceased was engaged. The mode of contemplating the world natural to the Egyptians, the reflex of a cold, jejune intellectual life, gave birth to a style of artistic representation which presents the most perfect contrast to the glowing, sensual, and poetic conceptions of the Greeks.

E. The Etruscans.

Although the art of the Etruscans at a somewhat advanced period adopted a good deal from the Greeks, still we find among them at a so much earlier date a tolerably advanced and original style of art, that we are compelled to consider it independently before directing our attention to classical antiquity properly so called.

The Etruscans were an industrious people, of a bold, enterprising spirit; and the structures reared by them, which long before the time of the Romans were equally remarkable for their extent and for the architectural skill displayed in them, are still partially preserved to us in their mighty ruins. It was with the aid of the Etruscans that the Romans began their buildings; Etruscans laid their walls; Etruscans constructed their canals; and the Roman houses were planned after the mode long in use among the Etruscans. The art of constructing arches with stones hewn into a wedge-like shape was also known to and practised by the Etruscans; although most of their walls were of a Cyclopean character, or built of polygonal stones.

The clearest idea of the degree of perfection reached by the plastic arts among the Etruscans is furnished by their works in burnt clay, of which a quantity have come down to us; and although many are formed after the Greek manner, there are many others which exhibit a distinct, well developed native style. Everywhere in them we discern a certain preference for plastic ornament. This preference is displayed in the form of the antefixæ, the acroteria, and the reliefs and statues in the pediments of the temples. The Etruscans even executed colossal figures in burnt clay; witness the quadriga on the Capitoline temple, and the statue of Jupiter in the same, both of which were formed of burnt clay.

Along with this branch of plastics, properly so called, we find that the Etruscans possessed the art of brass-founding; and they had both bronze colossi and little statuettes, many of which have come down to us; and bronze statues, which they knew how to gild, adorned the temples and their pediments. In addition to casting there was practised the art of chasing (*toreutics*); and this enabled them to produce embossed works in gold and silver, which were among the articles most eagerly sought after even during the most flourishing period of art in Athens and in Rome. Among these we reckon candelabra, goblets, mirrors, shields, chairs, trestles, &c., &c. Carved works in ivory also come from Etruria. The art of sculpturing stone in relief seems not to have been extensively practised; for but few of the extant specimens of that class of sculptures exhibit the careful and firm handling to which we are accustomed in the productions of the flourishing period of Etrurian art. Most of these ancient remains that have been found in the country in recent times belong to a much later and degenerate period of art, probably to the times of the Roman domination. *Pl.* 1, *figs.* 7, 8, are fragments of Etruscan sarcophagi; these were usually of alabaster, tufaceous limestone, travertine, and sometimes of burnt clay; and were adorned with bas-reliefs, which mostly pertain to the tragic mythology,

and contain many allusions to death and the lower world. Thus for instance, *fig.* 8 exhibits the Etruscan Mantus, or leader of the dead, armed with a hammer. Other representations of the kind are Mania, the goddesses of the lower world, the Furies, &c. Parting scenes, dying scenes, and funerals, are also frequently represented on such sarcophagi.

2. Classic Antiquity.

A. The Greeks.

1. First Period (previous to 580 b. c.). The Greeks, originally an Egyptian colony, had their seat from remote times in Greece proper, a part of the coast of Asia Minor, and Lower Italy; and there they had fixed dwellings, with temples and citadels, which were mostly founded by the Pelasgi. We still discern the ruins of the cities of Mycenæ, Tiryns, &c., whose origin dates from that period. The climate and the natural scenery of the country contributed to produce a beautiful equilibrium between the sensual and the spiritual in the life of this people; but a long period of development and many favorable circumstances were needed before the innate artistic sense could exhibit itself in external materials as an actually formative art. Yet we find even in the so called heroic period, *i. e.* in the times succeeding the domination of the Hellenic races, a certain love of splendor evinced in the construction of their houses and in their utensils.

In the period depicted by Homer, great progress had already been made in the decoration of utensils; and works were executed not only in wood, but likewise in the precious and the base metals, and in ivory and amber. The ark of Cypselus, which was sent as an offering by the Cypselidæ, the tyrants of Corinth, to Olympia, stood there in the Heræum (temple of Here), and is famed for its beautiful workmanship. It was pretty large, of an oval form, and made of wood, with figures partly carved out of the wood, and partly of inlaid gold or ivory. These ran round the chest in five rows one above the other, and represented scenes from the heroic epic cycle, which related to the race of the Cypselidæ.

In these times the art of working in metals had also attained to great perfection. The description given by Homer of the shield of Achilles presents us with an elaborate composition consisting of many figures; although it may be suspected that these consisted not of embossed but of inlaid work. The art of casting in metal was invented and perfected in and after the time of Homer. The invention is ascribed to Rhœcus the Samian, a son of Phileas, and his son Theodorus. Rhœcus was an architect and built the Heræum in Samos. His sons Theodorus and Telecles worked with him on the Heræum, laid the foundation for the temple of Diana in Ephesus, and cast brazen statues. Theodorus, son of Telecles, was not an architect, but confined himself wholly to working in metals. He wrought for King Crœsus a great silver vase, set the ring of Polycrates, and made a golden vase for the palace of the king of Persia.

At the same time with casting, Glaucus of Chios invented the art of soldering; and to him also is attributed the art of softening iron and hardening steel. Glaucus was highly celebrated for his works in metal, and there was in the temple at Delphi a very beautiful pedestal to a vase, of his workmanship.

The potter's art flourished at the same time, especially at Corinth; and very beautiful vessels of pottery were made there by mixing the very fine clay of the place with fine sand. Dibutades, who is said to have invented the art of drawing (or at least the silhouette), was the first, according to Pliny, who mixed ruddle with clay and thus colored it. To him our red crayon is also ascribed.

If now we pass to the art of sculpture properly so called of those times, we find that Homer makes no mention of statues; whence it ensues that only the art of carving in relief had then been invented. The most ancient remains of sculpture that have come down to us, the lions over the gate of Mycenæ, are reliefs, as also a Niobe on a rock of Sipylus, near Magnesia. The principal cause of this circumstance may lie in the then imperfect development of technical skill; but be this as it may, the fancy of the Greeks was then so much occupied in depicting the wonderful and the superhuman, that the hero-myths were more suited to the representations of poetry than of plastics. This we see from the poems of Homer, where the gods constantly appear in gigantic and often in ghost-like forms, that cannot be clearly defined. It is for this reason that the earliest representations of the gods make no claim at all to be considered as images of the deity, but are only symbols, often unhewn stones, stone pillars, wooden posts, &c. Thus for instance in the temple of the Graces at Cyzicus there was a triangular pillar, which Athene herself had presented as a first work of art; the *Hero* at Argos was a stone pillar, the *Athene* at Lingus a smooth log, and the *Dionysius* at Thebes a pillar encircled with a garland of ivy. Afterwards, in order to image the deity more precisely, attributes were added, and at last arms which held these attributes. In this manner arose the terminal statues or *Hermæ*, which long remained the only mode of representing the gods.

The wood-carvers first ventured to make entire images of the gods when the attributes rendered the whole figure necessary; and such images, as *e. g.* the *Ionic Palladium*, were then regarded as of the most sacred character. The feet, according to the simplest manner, were not separated, and the eyes were indicated by a stroke. Afterwards a walking attitude was given to the statues, and eyes slightly opened; but the hands, when they had nothing to bear, hung close against the sides. In the last century of this period metal statues of the gods first made their appearance.

2. Second Period (580—460 b. c.). With the increasing wealth of the Greeks and their constantly extending relations, there were introduced among the people a greater degree of refinement and a more highly cultivated taste for art; gymnastic games and pantomimic representations had reached their most flourishing state about the 50th Olympiad, and excited a lively enthusiasm for the beautiful and the significant in the human

figure. The athletæ first directed attention to a closer study of nature, and artists exerted themselves to celebrate distinguished combatants by portraits and statues: the perfection thus attained was of course transferred to the representations of gods and heroes. Here also the best works were executed in relief; and we find in the figures of the gods on the dedicatory craters and tripods spirited representations of the human form. These figures already exhibit both character and expression. Nevertheless the type originally adopted was departed from only by degrees. The pious regard for ancient usage was extended even to the material; though gradually the practice was introduced of putting a head or arms of marble, ivory, or gold upon the wooden body, until at last they went so far as to employ the art of casting in metals for the representation of the deities in their temples.

During this period the gods were represented as sitting enthroned, or in some other quiet and fixed posture; no attempt is made to charm; the limbs are powerful, the expression stiff and grave, and the colossal statues of the gods frequently have smaller inferior deities, which indicate their character, or other sacred objects, placed upon their outstretched hand.

Of a precisely similar character were the mythological groups which served to adorn the gable fields, the friezes, metopes, and acroteria of the temples; and these ornaments had reference either to the deity to whom the temple was dedicated or to the family legends of the dedicator. The sculptures on the temples of Ægina, of Selinuntiæ, and from the ruins of Xanthus may be considered as forming the limits of this period. The sculptures discovered in the year 1823 near the middle temple of the acropolis of Selinuntiæ, and now in Palermo, are metopes of a Doric temple, wrought in tufaceous limestone, and are 4 feet 9½ inches high, and 3 feet 6½ inches broad; they belong to the very earliest period of art. They exhibit traces of having been painted, as is everywhere observed in the architecture of Selinuntiæ. One of these metopes, which we have copied in *pl.* 1, *fig.* 12, represents Hercules carrying off the captured Cercopes suspended from a pole. Hercules is naked; yet there are traces which show that on the body was fastened a lion's skin of gilded bronze. Another metope found there represents Perseus with the cap and winged shoes of Hermes, Athene in the peplus, and Medusa with Pegasus. From other sculptures of a frieze in the cella, as of a goddess transfixing a warrior, the torso of a dying warrior, &c., we have selected the mask of a figure (*fig.* 6).

The Æginetan sculptures were discovered by several Germans, Danes, and Englishmen in the year 1811; they were restored by Thorwaldsen and transported to Munich, where a separate apartment was appropriated to them in the Glyptothek. They formed two corresponding groups in the fields of the two gables of the temple of Athene in Ægina; the western group is the most complete, although the figures of the eastern group are somewhat better executed and of a larger size. Athene heads the combat of the Æacidæ or Æginetic heroes against Troy: in the western group, the battle is around the body of Patroclus; and in the eastern

group, about that of Oicles, who, as companion in arms of Hercules against Laomedon, was slain by the Trojans. Of these sculptures we have given *fig.* 10, Athene, *fig.* 11, an archer, Paris, and *fig.* 9, a heavy-armed warrior, Hercules; and in *fig.* 5 is given the head of another warrior. Gilded bronze was here and there fastened on to the marble, as is shown by many holes still existing in the statues, from which the position of the weapons attached to them can be made out. The hair also was partly made of wire fixed on the heads of the figures. On the weapons, the dresses, the pupils of the eyes, and the lips, but not on the other parts of the body, traces of color are found. The arrangement of the groups is simple and architecturally symmetrical, being adapted to the shape of the gables.

These sculptures have their counterpart in those of a large tomb discovered by Fellows in the year 1838, at Xanthus; which must necessarily be as old if not older than those of Ægina, since Xanthus was taken and destroyed by Harpagos in the third year of the 58th Olympiad. The sculptures of this place are found in five different tombs; but one of them, the largest and best preserved, is the most remarkable. On a base stands a quadrangular tower consisting of a single block of limestone; its top was once surrounded by a frieze, which was about 20 feet from the ground, and above it was a bold cornice with an abacus. The frieze is now in London, and is set up in the British Museum. The figures on it are about 3 feet 6 inches high, and are distributed over three slabs of white marble on either side. The east and west sides are 8 feet 4 inches long, the north and south sides somewhat shorter. On the west, which is the principal side (*pl.* 1, *fig.* 14), the frieze is interrupted by a small doorway, over which is represented a cow suckling her calf. This opening leads into a chamber 7½ feet high, and doubtless was intended not for entering the monument but for placing within it a cinerary urn, or something of the sort. The style of art exhibited in these sculptures is purely Greek, and several of the figures are found repeated with great similarity on other monuments. This renders more striking the dissimilarity in the religious rites, the deities, and their attributes which they represent. The compositions of the four sides stand in evident connexion with each other. On one side, the western (*fig.* 14), appear Demeter and Cora, the former with a patera, the younger figure with a pomegranate and a flower. Before her stand the three Horæ or Charites, the middle one with a pomegranate, the hindmost one with an egg. The other three sides (the northern is depicted *fig.* 13) are occupied in the middle by three gods sitting enthroned, with staves in their hands, and wearing wide-sleeved garments and mantles; two of them are bearded, but the third, although also old, is without a beard. These three gods may be Jupiter, Neptune, and Pluto, as appears from their attributes, which are a quadruped that looks like a bear, a triton on the throne of the second, and a pomegranate in the hand of the third. To these three gods a family appear to be making offerings: the man in armor presents a helmet, the woman a dove, and the child a cock and a pomegranate. The child is represented on the long eastern side; on which there are also two female figures and a man with a staff and a dog. On the northern and southern

sides there is placed on each side of the main group a harpy carrying off a young girl. While these accessories are perfectly suitable and intelligible as sepulchral designs, the main groups seem incapable of explanation with reference to the native mythology and symbolism. Of colored ornament nothing is perceived besides the blue ground, except a little red on the peak of the helmet, and also on the edge of the plinth and on the throne.

If we now cast a glance at the style of art at this period, we find that the forms of the body are excessively muscular, the joints and sinews exceedingly prominent, and the contours consequently hard and trenchant. This very boldness in design led to that truth to nature which has been so much admired in the sculptures of Ægina for instance; still the proportions are short and somewhat stumpy. The gestures are rather violent, although along with great animation there is always a certain stiffness, something abrupt and angular. On the other hand a great deal of delicacy is exhibited in the neatly and regularly folded garments; the nicely braided, wire-like curling, and symmetrically arranged hair; in the peculiar position of the fingers constantly observed in taking hold of sceptres or staves, and with female figures in holding up their dresses; in the gliding movement on the extremities of the feet; and in numerous other particularities. In the shape of the head there reign at this period certain fundamental forms, which owe their origin partly to the ancient imperfection of art and partly to an inelegant conception of the national features, and which became so firmly settled into a type as to be retained even after a persevering study of nature had greatly improved the drawing of the other parts of the body. To this belong (*pl.* 1, *fig.* 5) the far retreating forehead, the peaked nose, the mouth drawn in with the corners elevated, the flat elongated eyes, the angular chin, the lank cheeks, and the ears placed very high.

Of the statues of wood of this period nothing has come down to us; and of the works in bronze, with the exception of analogous works in Etruria, only a very ancient stiff bronze figure has been preserved. On the other hand, besides the above mentioned sculptures, there exist a few others which belong to this period. Prominent among these is the statue of Athene in the Dresden collection of antiquities, on whose peplus the Battle of the Giants is represented in relief. There are also a number of reliefs of this period distributed through various museums. Of these we will mention here only the *Theft of the Tripod*, which was a favorite subject. In Dresden there is a three-footed stand for a tripod, one side of which we have copied in *pl.* 3, *fig.* 11. Here the tripod, which on one side of the stand Hercules is represented as stealing and Apollo endeavoring to prevent the theft, has been brought back to the temple and set upon the altar; a priestess is decking it with sacred fillets, and a priest as Neocorus (temple-servant) stands by, holding a broom, the sign of his office. The third side represents the preparation of the altar for giving responses, by a priestess and a priest or soothsayer. To this period also belong the altar of the twelve gods now in Paris, and the decoration for a fountain preserved in the Capitoline Museum. We have copied a portion of it (*pl.* 3, *fig.* 10), on which Vulcan, Neptune, Mercury, and Vesta are represented with their

attributes. This marble relief is still in very tolerable preservation, and is one of the principal monuments in which we may study the early Greek style.

Remains of the arts of die-cutting and coining have also come down to us from those ancient times. Coins were stamped already under the Argive king Pseido in the eighth Olympiad; but it is not till the period of which we are treating that two-sided coins occur, whereas before only one side was stamped, and the back showed the mark of the support on which it was placed (*quadratum incusum*). We give as a specimen of the coinage of this period a silver coin of Gela. The obverse side (*fig.* 22) exhibits the fore part of a bull with a human face, intended no doubt for Bacchus under the form of an animal; the reverse (*fig.* 23) represents a quadriga, which is crowned by a victory. The obverse bears the Greek inscription ΓΕΛΑΣ, the name of the city to which the coin belongs. Another belonging to this period is an Attic coin, and represents on the obverse (*fig.* 25) the head of a lion with the fore paws, and on the reverse (*fig.* 26) a Gorgon's head with a protruding tongue. Both these coins are of great value for the study of the archaic, or so-called powerful, Grecian style of art. A third coin of this period, likewise of Attic origin, exhibits (*fig.* 24) a Minerva Polias seated and holding the serpent to which she had intrusted the charge of Erichthonius.

3. Third Period (460—336 B. C.). This period embraces the time from Pericles to Alexander. Athens, which had now become the centre of Greek civilization, arrived rapidly in consequence at the height of a power equal to that ever enjoyed by a city; and the great wealth which the Persian wars had but slightly laid under requisition was at first expended in fortifying Athens, and afterwards in magnificently adorning the city itself; for in this period were erected the temple of Theseus, the Parthenon, the Propylæa, the Odeon, the Theatre, and many other splendid buildings in Athens. With the progress of architecture sculpture naturally kept even pace, and both soon spread over the whole Peloponnesus. The productions of art still exhibited everywhere the repose and severity of the olden period, although more flexibility and grace are observable in the figures. But when, in consequence of the Peloponnesian war, the power of Athens had been undermined, and previously existing ties were dissolved, art also struck out into new paths, and exhibited in its creations more sensibility and passion, a disturbed equilibrium, and an uneasy striving of the soul after external impressions.

In the period of which we are now treating new schools of art were formed, and Calamis and Pythagoras spread their style over all Greece. Although not free from hardness, their works present much to admire, particularly in noble statues of the gods, delicate and graceful women, and fiery steeds. Immediately after these two artists and their pupils arose Phidias, a master, whose fame was so great and whose genius so powerful that the whole host of artists then collected in Athens adopted his ideas. Phidias himself worked chiefly at colossal statues composed of gold and ivory, to the magnificent execution of which an unexampled liberality on

the part of the states and a more extended technical knowledge mutually contributed. Here belongs *e. g.* the colossal statue of Pallas in the Parthenon (*pl.* 4, *fig.* 1), which represented a virgin clad in armor, but victorious and ruling in serene majesty. The grandiose simplicity of the principal figures was relieved by rich ornaments on the pedestal, the arms, and even the edge of the sandals. Athene here bore an ægis with a Gorgon's head; on her helmet was a sphinx executed in full supported by griffins in relief; in her hand a spear; and at her feet a shield, on which her left arm rested, supporting in its hand an image of the goddess of Victory four cubits high. The sacred serpent of Erichthonius coiled itself at the feet of the goddess. On the inside of the shield was represented the Combat of the Giants, and on the outside the Battle of the Amazons. On the edge of the Tyrrhenian sandals was a relief which portrayed the Combat of the Centaurs and Lapithæ.

Besides these statues and other works of the brass-caster's and metal-worker's arts, Phidias executed numerous statues of gods and heroes of brass and marble, especially many modifications of the statue of Athene, among which was distinguished the colossal statue of Pallas Promachos, which, standing between the Propylæa and the Parthenon, towered above them both, and was visible far out at sea. This statue was left unfinished at the death of Phidias; and it was not until nearly a generation later that Mys completed, after designs by Parrhasius, the Battle of the Centaurs on the shield and the other chased works with which the molten statue was adorned. Agoracritos and Alcamenes, pupils of Phidias, also executed many statues of the gods, and the *Aphrodite* of Alcamenes is celebrated. There now exist of the works of the Phidian school only the sculptures that decorated some of the temples of Athens. There are still preserved some of the eighteen sculptured metopes of the temple of Theseus. In the ten metopes towards the east the exploits of Hercules, and in the eight towards the south and north those of Theseus were represented. Besides the sculptures of the temple of Theseus there are also a considerable number of sculptures from the Parthenon. To these belong: 1. The metopes, about 4 feet high, having a projection of about 10 inches. There were 92 tablets in all: 15 from the south side are now in the British Museum, 1 in the Louvre in Paris, besides fragments in Copenhagen; and 32 from the south side were drawn by Carrey, at the order of Count Nointel, the French ambassador to the Porte in the year 1674, when the building, which has since been greatly injured, was still in a tolerable state of preservation. 2. The frieze of the cella, 3½ feet high and 528 feet in length, of which about 456 feet are still pretty well known. Of these, besides the plaster casts of the entire west side, there are 53 tablets in the British Museum, and one in the Louvre (*pl.* 3, *fig.* 9). Four have only recently been dug up in Athens. The whole represent the procession in the Panathenæan festivals. On the west side was seen the preparation for the cavalcade; then in the south and north were seen, in the first half, the cavalry of Athens galloping in bands; next, those who took part in the chariot contest after the procession, accompanied by goddesses of battle as charioteers; and further to the south the aged men

and women of the city; in the north were choirs with flute and cither-players, bearers of vessels and offerings (*ascophoræ*, *canephoræ*, *hydraphoræ*), and furthest in front and on both sides bullocks for sacrifice with their attendants. On the east side are seated, surrounded by virgins who bring the offerings and the presiding magistrates, twelve gods, between whom the priestess of Pallas Polias and the priest of Poseidon Erechtheus form the central group. 3. Statues in the pediments. The pediments are 11½ feet high and 94 feet long; the depth of the lower cornice is 2 feet 11½ inches. The British Museum possesses nine figures from the eastern pediment, and from the western pediment one figure and five considerable fragments. Carrey's drawing gives the western pediment almost complete. In the eastern pediment is represented Athene's first appearance amongst the gods; in the western pediment, Pallas contending with Neptune for the sovereignty of Athens conquers him by causing Erichthonius to harness up the horses which Neptune had made. Here belong the horse's head (*pl.* 3, *fig.* 18) and the animals' heads (*figs.* 19 and 20), which however are taken from the frieze.

The influence of the school of Phidias, which had left the early stiffness completely behind it, manifested itself also in the temple sculptures of other parts of Greece, but modified by the genius and taste of other masters and pupils. We may instance the sculptures of the temple in Olympia, which, although freed from the fetters of the early style, are far from having attained the grandeur of the ideal conceptions of Phidias. The reliefs from the friezes of the temple of Apollo Epicurius in Phigalia, which are in the British Museum in an almost perfect state of preservation, represent the Combat of the Centaurs and the Amazons in the sight of Apollo and Diana, and betray in individual groups unmistakable indications of Athenian models. They display in the composition a matchless power of invention and a most lively fancy; nevertheless there appears in them a far less refined feeling for forms, a fondness for excessively violent gestures and incorrect attitudes, a hang of the garments with peculiarly awkward folds almost as if ruffled by the wind, and in the general treatment of the subject itself a harsher character than is to be found in the school of Phidias.

Along with the Attic school there arose under Polycletus that of Sicyon and Argos. Although Polycletus in his colossal statue of Hera in Argos had brought the art of casting and graving to a higher state of perfection, he showed himself far inferior in invention to Phidias in his statues of gods; but the art of modelling statues of athletæ in brass which prevailed in the Peloponnesus was brought by him to the greatest perfection, since here all that was required was to represent the most symmetrical proportions of the youthful body. And hence one of the statues of Polycletus, the *Doryphorus*, became the canon of proportions of the manly form, which however was then somewhat shorter and stouter than it afterwards became. To Polycletus is also ascribed the establishment of the principle of throwing the weight of the body in a statue principally on one foot; whence resulted the beautiful contrast between the supporting and com-

pressed, and the supported and more developed half of the human body. Under such circumstances it may well have been the case that Polycletus gained the victory over Phidias, Ctesilaus, and others in an artistic contest the subject of which was the representation of an Amazon. The Amazon of Phidias, leaning on a lance and preparing for a charge, is in the Vatican; the wounded Amazon of Ctesilaus (*pl.* 3, *fig.* 7) is in the Capitoline Museum: and as both these statues are very beautiful, we may well suppose that of Polycletus to have been of the highest excellence in the representation of these blooming and powerfully developed female forms.

The spirit of art manifested itself still more corporeally in Myron of Eleuthera, whose own personal qualities led him to a vivid conception and representation of the forms of animated nature. His cow, his dog, and other similar productions were exceedingly spirited, and his quoit-pitcher (*discobolus*), represented in the act of hurling, is shown, by the numberless imitations made of the statue, to have been of the highest perfection. Among mythological forms that of Hercules suited him best, whom he sculptured along with Zeus and Athene in a group for the Samians. His formation of the countenance, however, remained but indifferent; and his stiff treatment of the hair corresponded to that of the earlier brass statuary in the period of the Æginetic sculptures.

His opposites were found in Callimachus and Demetrius. The works of Callimachus were distinguished by an industry that was never contented with its performances, nay he sometimes spoilt them by his too anxious and minute execution of details. He invented the application of the drill to working in marble. Demetrius of Athens on the other hand was the first who in his fac-simile portraits, especially of old people, exhibited a faithfulness which went so far as to copy accurately even accidental defects and blemishes.

After the Peloponnesian war there arose in Athens a new school of art in accordance with the new condition of things in Attica. It was especially through Scopas, a native of Paros, and Praxiteles of Athens, that art first received that tendency to the delineation of the more excitable and tender feelings which corresponded to the frame of men's minds at that time; although it must be added that these masters united therewith a noble and grand conception of their subjects.

Scopas wrought chiefly in marble, whose milder lustre no doubt seemed to him better adapted to the character of his productions than glittering brass; most of his statues refer to the myth of Dionysus and Aphrodite. He was the first who represented the Bacchic frenzy in a free and unfettered shape, and his *Mænade* with wildly flowing hair sculptured in Parian marble was universally celebrated. The ideal of Apollo also owes to him the more graceful and animated form of the Pythian cither-player, which he effected by giving more life and spirit to the figure previously in use. Whether the group of *Niobe and her Children* in the temple of Apollo Socianus in Rome was the production of Scopas or of Praxiteles, the Roman connoisseurs themselves were unable to determine. At any rate the group manifests an art which loved to represent impressive and agitating subjects, but observed

at the same time a moderation and noble reserve which guard against any violation of the feeling for the sublime and beautiful. Unfortunately the group has come down to us in such a fragmentary condition, that it is hardly possible to judge of the composition and design which animated and held together its various parts.

Praxiteles likewise wrought chiefly in marble, and most of his subjects are taken from the myths concerning Dionysus, Demeter, Aphrodite, and Eros. It was he whose ideal images of Eros represented the perfect beauty and amiability of that boyish age which to the Greeks appeared the most attractive of all; while his nude Venus displayed the utmost luxuriance of charms joined to a spiritual expression which presented the queen of love herself as a woman filled with inward longing and in need of love. Splendid as the works of Praxiteles really are, still in his images of the deities (and to these he almost exclusively confined himself) there appears too prominently, in place of the divine dignity and sovereign might which are found in the works of the older sculptors, the worship of that beauty which charms the senses. This may have been in good measure the result of the artist's way of life, who lived constantly among the hetæræ. A like spirit pervaded the works of Leochares, whose *Ganymede* embodied the idea of the favorite of Zeus carried off by the eagle in a manner equally charming and noble. The growing fondness for the delineation of sensual charms manifests itself still more strongly in the hermaphrodite figures, an artistic creation which we probably owe to Polycles. The *reclining hermaphrodite* of which we have given a copy (*pl.* 3, *fig.* 3) is one of the best productions of this class. It is now in Paris, and was formerly in the villa of Borghese. It was discovered in building the church of Maria della Vittoria in Rome, and was presented by the clergy to Cardinal Scipio Borghese, who by way of acknowledgment built for them the façade of their church. Bernini restored it by replacing the left foot, and throwing a piece of drapery over it to cover the joint. The cushions are also by Bernini. There is another hermaphrodite in the Florentine Museum; but both are exact copies of the bronze hermaphrodite of Polycles.

As the first artists of this school still cherished the spirit of Phidias, and only so far departed from it as to endeavor to breathe into their gods and mythic figures an inner spiritual life, so Euphranor and Lysippus showed themselves disciples chiefly of the school of Polycles or of Argos and Sicyon, whose chief aim was the representation of physical beauty and athletic strength. The favorite of Lysippus among the heroes was Hercules; and him he delineated in a new manner, developing with such skill his muscles and limbs, as to serve as a model for all future representations of that hero.

This conception is shown in the *Farnese Hercules* (*pl.* 5, *figs.* 1 and 2), which is a copy of Lysippus by Glycon the Athenian. This colossal statue was found in the baths of Caracalla, under which emperor it was probably brought to Rome. The hand with the apples is new, the legs also were restored by Giuliano della Porta; but when in 1787 the original legs belonging to the statue were found, they were put on again in place of the new ones.

The study of nature was pursued with great zeal at this period along

with that of the works of the older masters, and this was the source of many refinements in matters of detail. Thus, for example, Lysippus put on the hair more naturally and with picturesque effect. Artists also bestowed the greatest attention on the study of the proportions of the human figure; and Euphranor (with Xeuxis among the painters) adopted a much slenderer model; this Lysippus was the first to reduce to harmony, after which it became the predominant one in Grecian art. It must be confessed, however, that this system was less the offspring of a warm and intimate appreciation of nature than of a desire to elevate the productions of art above those of actual life. There is also exhibited in the works of the latest artists of this period a strong tendency to the colossal, which became predominant in the subsequent period. The *Jupiter* of Lysippus at Tarentum was 40 Grecian cubits (about 68 feet) high.

4. Fourth Period (336—146 B. C.). The conquest of Persia by the Greeks gave to Grecian artists many occasions for the display of their skill, while it also communicated a peculiar direction to art itself: as the artists' sphere of observation was extended, and the wonders of the East excited them to emulate the magnificence and splendor of its works. But as there existed a firmly established style of art developed from a native germ in the different peoples on the one hand, and a strong line of demarcation between the conquerors and the conquered on the other, no hybrid style resulted from this cause, but Grecian art, even when transplanted abroad, remained Grecian still.

Nevertheless we meet with a peculiar phenomenon in this period of art. The external relations of Greece and its connexion with foreign countries had called forth a hitherto unknown fondness for splendor and had thus given a new impetus to the life of art; while the internal and properly creative energy, after the natural Hellenic circle of ideas had been embodied in plastic forms, was brought to the necessity either of pausing in its career or of being artificially spurred on to a new flight. The latter took place in fact; and accordingly we find in the period of which we are now treating a striving after effect, even at the expense of what is truly valuable in art.

In the beginning of this period we find that along with the disciples of Praxiteles the most flourishing was the Sicyonian school, in which brass-casting was practised in the ancient perfection and in a noble style, especially by Euthycrates; but afterwards this art fell into disuse, until it was revived again in Athens towards the end of this period through the study of the older works of art, when the Grecian taste obtained the supremacy in Rome. The school of Rhodes was a branch of that of Sicyon, and Chares of Lindus, a pupil of Lysippus, cast the largest of the hundred colossal statues of the Sun, which was reckoned one of the seven wonders of the world. This colossus, which stood not *over* but near the harbor, was 70 Grecian cubits high, and was cast in a number of pieces. To this period belongs also most probably the *Laocoön* (*pl.* 6, *fig.* 7), a miracle of art as respects the fine and noble taste displayed in the execution of so difficult a task, but evidently calculated for dazzling effect and the exhibition of skill,

and perhaps of a somewhat theatrical character. At all events pathos is carried in this work as high as the nature of the plastic art admits, and especially much higher than it was ventured to carry it in the time of Phidias. The group of *Laocoön*, who with his two sons is encircled and killed by two serpents, and of which Pliny speaks with great admiration, was found in the year 1506 in the Baths of Titus, and now stands in the Vatican. It consists of six pieces: the right arm is new, and was restored after a model by Giovanni Agnolo; a portion also of the feet is new. The group known by the name of the *Farnese Bull*, and which in ancient times was much admired and frequently copied, belongs also to this period.

Here too we must mention Pyromachus of Pergamus, who celebrated the victories of Attalus I. and Eumenes II. over the Celts by groups of warriors cast in bronze; for to these groups some celebrated statues owe their origin, as the Ephesian sculptors then likewise engaged in the execution of such works. Here belongs in all probability the *Dying Gladiator* (*pl.* 5, *fig.* 5), which was formerly attributed to Ctesilaus, but which the arrangement of the hair, the chain about the neck, and other peculiarities manifestly show to be a Celt. Accordingly we must regard it as a production of Pyromachus. Its affecting character, together with the accurateness of design and the profound study of anatomy which this statue evinces, has made it in all times an especial favorite with artists and connoisseurs.

In Ephesus the three Agasiases were celebrated as sculptors, and we possess from the hands of one of them, the son of Dositheos, the celebrated statue of the Louvre in Paris known by the name of the *Borghese Gladiator*. That this statue represents a warrior (although Lessing took it for a Chabrias, Mongez for an athlete, Hirt for a foot-ball player, and Quatremère de Quincy for a racer) is certainly the most probable supposition, if we assume that this warrior was engaged in defending himself with spear and shield against the attack of a horseman. This statue probably formed part of a large group by Agasias.

In the cities where the Macedonian rulers resided statues were executed for the temples about this time; but they exhibited little that was new in the way of invention, being for the most part mere copies of celebrated earlier works. Still the custom of glorifying the kings by portrait-statues and busts produced many new and spirited masterpieces, especially since artists carried their flattery so far as to represent the rulers in the form and costume and with the attributes of certain deities. Thus Alexander appeared at one time adorned with the dress and the horns of Zeus Ammon, and at another with the lion's skin and club of Hercules. Busts of kings, poets, philosophers, orators, &c., were made at this period in countless numbers, and not a few of them have been preserved even to our day. On *pl.* 3 we have copied some of them, in order to show their style and mode of treatment: of these *fig.* 12 is a bust of the poet Homer; *fig.* 13, that of the philosopher Periander; and *fig.* 15, that of Thales of Miletus. We have given in *fig.* 14 the bust of Theophrastus, and in *fig.* 17 that of Hippocrates; *fig.* 16 is the bust of the famous orator Æschines. Besides the portrait-

statues a great deal was done in the way of highly ingenious embossed work in vases and utensils of metal; and Syria, Asia Minor, and Sicily were full of such works.

That art in spite of every exertion had declined in the time of Philip and Antiochus the Great, is not to be disputed; yet soon after there arose, especially in Athens, statuaries in brass, who, if they did not reach the ancient lofty point of art, still produced excellent things. They were joined by Cleomanes, an Athenian, who in his *Venus* showed himself remarkably happy in carrying out the idea of Praxiteles. This Venus, known by the name of the Venus de' Medici or the *Medicean Venus* (*pl.* 4, *fig.* 2), was when found in a very mutilated condition. The statue consists of eleven pieces, and the hands and part of the arms were wanting; the ears bore ornaments, and the beautifully arranged hair was gilded. This Venus is an imitation of that of Cnidus; but her nudity no longer needed the excuse of the bath, and even the dolphin is only a support and not intended to indicate a sea voyage. At this time flourished Glycon, of whose statue of Hercules we have already spoken, and Apollonius. They both took the works of Lysippus as their chief models.

The arts of die-cutting and gem-engraving were practised to a great extent during this period, especially after the custom had been adopted from the east of ornamenting vases, lamp stands, and such like objects with jewels or engraved stones. As the gems in this case were not to be used as seals, they cut them in relief, in the form of cameos, for which purpose the variegated onyx was frequently made use of. The finest production of this kind is the Gonzaga cameo, now in the possession of the emperor of Russia. It is nearly six inches long, and represents (*pl.* 3, *fig.* 21) the profile portrait of Ptolemy II. and the first Arsinoe in a style remarkable for its beauty and spirit. Another exquisite cameo, though not equal to the preceding, is in the Vienna Museum, and exhibits the heads of the same Ptolemy and of the second Arsinoe. Entire goblets and pateræ were at this period carved out of precious stones (*e. g.* of onyx), and were real miracles of beauty and of perfect execution. The dies for coins at the beginning of this period were excellent, but towards its close they betray a decline in art.

The seizure of works of art, which under various pretexts had been practised towards conquered nations from the earliest times, became in the time of the Roman domination a regular reward which the Roman generals and governors took to themselves for their victories; and although in these plunderings some degree of moderation was at first observed, as under Marcellus and Fabius Maximus, they were soon carried on without any restraint. Under Sulla many statues found their way into the melting-furnace, and this robbery of art was pursued systematically by Verres; he was followed by the emperors; and an approximate calculation of the number of statues then brought out of Greece amounts to nearly a hundred thousand.

Together with the works of art, art itself removed to Rome, and after the fall of Greece, Italian art alone lays claim to our attention.

B. The Romans.

1. First Period. (Previous to the Year 600 a. u. c.) In the period during which Rome remained under the Etruscan kings, it also, as an Etruscan capital, received its temple statues (of which it had none previously) from the hands of Etruscan artists, although they consisted of nothing but images of wood and clay. Even during the times of the republic, the Romans, in their zeal to promote the common welfare, applied their practical sense so exclusively to grand and practically useful undertakings, such as making aqueducts and roads, that but little attention was bestowed on the cultivation of art for its own sake. Nevertheless political ambition gradually gave an importance to the plastic arts. The senate and people, and also grateful foreign states, erected statues of brass in the public places to men of desert; and the first statue of this metal, according to Pliny, was a Ceres, which was paid for out of the confiscated property of Spurius Cassius. When in the time of the Samnite war the dominion of Rome was extended over Magna Græcia, they began, after the manner of the Greeks, to dedicate statues and colossi to the gods out of the spoils of war.

The coins of those times and the productions of the gem-engraver show a very rude state of art: the impress is flat, the figures coarse, and the head of Roma without beauty. Apart from the coins, no specimens of the imitative arts of that period have come down to us.

2. Second Period. (From thenYear 600 a. u. c. to the Middle Ages.) During this period art was concentrated at Rome. This, however, was owing merely to political ascendency, and by no means to high artistic talent; for the Roman genius always remained too wholly devoted to practical and political life, to allow full scope to that careless ease and free play of the fancy which give birth to art. The taste of the Romans for art may be best divided into the following epochs. 1. *From the taking of Corinth to the reign of Augustus.* The fondness of the great for splendor attracted artists to Rome, and in consequence a certain taste for art was awakened, the artists occupied themselves in imitating and emulating the ancient works, and connoisseurship and learning in art took up their abode in Rome. 2. *The time of the Julii and Flavii.* The emperors understood how, by promoting art and by great structural undertakings, to turn the people's attention from political matters, and even the half crazy enterprises of some of them were the means of furnishing employment to artists and fostering art. Although the artists had already departed considerably from the noble simplicity of the old masters, still a decided decline of art was not yet perceptible. 3. *From Nerva to the time of the Thirty Tyrants.* During the long continued peace there was a transitory flickering up of art in Greece and in Rome under Hadrian; but gradually a want of inner life and spirit became manifest, and was succeeded by jejuneness and pomposity. The transplanting of the worship of Isis to Rome was not without an injurious influence on art, as it weakened the spirit of Greco-Roman culture. 4. *From the Thirty Tyrants to the Byzantine period.* The ancient world fell, and with it ancient art. With the declining faith in

the gods of paganism there disappeared the entire mode of viewing things in which ancient art originated, and art itself was subjected to the service of a tasteless semi-oriental ostentation.

If now we cast a somewhat closer glance at the state of art in the epochs above indicated, we find that under Octavian and his predecessors in Rome a number of sculptors and brass-casters distinguished themselves, among whom were Pasiteles and Arcesilaus. The models of the latter were more highly prized than the finished statues of other masters. There was also no want of artists who made very beautiful silver vases; and among the coins of that time there are many that can vie with the Greek. Under the empire the arts appear already degraded to the service of luxury and caprice; yet there were still admirable sculptors, who adorned the palaces of the Cæsars with marble groups of beautiful invention. The bronze caster Zenodorus cast a colossal statue of the emperor Nero 110 feet high, which was set up before Nero's golden house; but when the temple of Venus and Roma was erected on the spot, the colossus was removed with the aid of twenty-four elephants. The best sources for the study of the art of that period are: 1. The sculptures on public monuments. Among these are the reliefs on the Arch of Titus, representing the apotheosis of the emperor and the triumph over Judæa, well designed and arranged, but negligently executed; and likewise the reliefs on the Forum of Nerva, which are beautifully designed, but badly draped. 2. The statues of the Emperors. Of these some are very well executed, both as clad in the toga and in the accoutrements of war. Another mode of representation, that of exhibiting the emperors in a heroic or deified character, was at this time very much in vogue. These were either naked Achillean statues armed with a spear, or they were modelled in a sitting posture with a peculiar drapery designed to suggest the idea of Jupiter. Of the former kind we have still several specimens, *e.g.* the Pompey in the Palazza Spada, the Augustus in the Casa Rondanini, &c.; and likewise of the latter, *e.g.* the sitting statues of Augustus and Claudius, from Herculaneum, and a standing Augustus of bronze holding the thunderbolts, also from Herculaneum, &c. The gems of this period furnish equally important materials for the history of art. The greatest master of the time in this branch was Dioscorides, who among other things engraved a head of Augustus which the emperor himself used as his seal. But still more important than the intaglios are the cameos, which represent the members of the Julian and Claudian families at different epochs, and which, besides the splendor of the material and the skilful way in which it is employed, are also remarkable for their execution. Of the gems of this period which have come down to us we will particularize here only the three largest: *a.* The Paris cameo, 13 inches by 11, a sardonyx of five layers, representing the apotheosis of Augustus; *b.* The Netherland cameo, 10 inches high, a sardonyx of three layers, admirably designed, but poorly executed, representing Claudius as a Jupiter triumphant with Messalina, Octavius, and Britannicus on a chariot drawn by Centaurs; *c*, The Vienna cameo, 9 inches by 8, the *Gemma Augustea*, of the most exquisite finish, representing an apotheosis of

Augustus. In the coins the same degree of excellence is observed, the heads being animated, characteristic, and noble, and the mythologico-allegorical composition ingenious and spirited, although sometimes carelessly executed.

Under Trajan were executed the reliefs of Trajan's Column. The figures are energetic, the heads characteristic, the positions good, and by ingenious motivos the monotony of military arrangement is avoided; so that the work, in spite of many faults in the treatment of the nude figure and of the draperies, has a high value. To it belongs the fragment in *pl.* 14, *fig.* 8, where Trajan is seen receiving the submission of a conquered king. Under Hadrian, in consequence of that emperor's fondness for art, partly affected as it was, it took a more elevated flight. This is shown among others by the statues of Antinous, the emperor's favorite, of which a great number were made. Astonishing is the skill with which this personage is represented by the artists in the various characters of man, hero, and god, while preserving and expressing his individuality in all of them. One of the finest statues of Antinous is that of Belvedere (*pl.* 6, *fig.* 1).

During the long reign of the Antonines, when the repose which Rome enjoyed failed to restore her former vigor, and when oratory degenerated into dull insipidity embroidered with bombastic phrases, the arts also assumed a jejune and insipid character in keeping with the general taste. Accordingly we here find busts of the emperors, in which the hair and beard luxuriating in excessive abundance, are executed with anxious care, while the expression given to the countenance is trivial in the extreme. The art of gem-engraving also shows a state of decline, and the coins both in invention and execution are of inferior merit.

The unquiet times of Commodus, and of Septimius Severus and his family, did not suffer the arts to rise, but caused them to hasten still more rapidly to their fall. The best works of those times are still the imperial busts, although here too taste seems trampled under foot. Perukes upon the head and draperies of parti-colored stones indicate the taste in which the whole is treated. The empresses were often represented with scanty clothing as Venuses; but the insipid portrait-like character of the countenance, to which is frequently added the head-dress of the period, plainly a peruke, presents for the most part a ludicrous contrast to the general design. Thus we find in the Museo Pio Clementino the statue of *Sallustia Barbia Urbiana*, the wife of Alexander Severus, as Venus (*pl.* 4, *fig.* 8), with an Amor at her side; and the statue of *Julia Socemias*, the mother of Heliogabalus (*pl.* 4, *fig.* 9), whose head-dress is made to put on or take off.

The best works of this time, which also exhibits some signs of a peculiar productivity, are the sarcophagi, the high reliefs on which, representing scenes from the legends of Demeter, Dionysus, and the heroic mythology, so modify the subjects as to express in many ways the hope of a life beyond the grave. The fable of Eros and Psyche is likewise often employed for this purpose; and the cleverly composed groups of the two lovers, one of which we have given in *pl.* 5, *fig.* 7, cannot be assigned to a date

previous to Hadrian, as the execution is not always of particular merit. At the same time art was employed to embody the ideas introduced by the invasion of Oriental culture, its services being now laid under contribution for the worship of Mithras, as they had been at a former period for that of the Egyptians. The Abraxas gems too, with the pantheistic figure of *Jao Abraxas* and other kindred forms, owe their origin to this period. But gradually the excess of elaboration gave place to meagreness and poverty; on the coins, which still afford the best clues to the then state of art, the heads are made constantly smaller in order to bring in also a part of the figure and accessories. At the close of the third century the busts lose all their relief, the drawing becomes incorrect, and the entire composition flat, characterless, and only distinguishable by the accompanying legend.

The works of the sculptors also become rude and awkward, as is seen in the reliefs on the Arch of Constantine and on the Column of Theodosius; the reliefs on the sarcophagi after the turgid, overloaded style of the figures of the Roman period, are subjected in the Christian monuments to an architectural arrangement, and in their execution are rude and meagre. The Christian worship favors painting more than sculpture; and it was only now and then that so called honorary statues continued to be executed, especially in Byzantium; but in these the character and individuality of the persons is entirely disregarded. The making of splendid vases of the precious metals and adorned with gems is the only branch of art that seemed to hold its ground still for a considerable time, and even here mere workmanship took the place of truly artistic composition.

The removal of the imperial residence to Byzantium, together with the introduction of Christianity, whose simple symbols and unostentatious worship furnished the artists of that transition period with no special incentive to the creation of new works, rendered the utter downfall of ancient art properly so called inevitable; while the inroads of the Germanic tribes into Italy, the wars, famine, pestilence, and all kinds of suffering which afflicted Rome in the sixth and seventh centuries, caused the destruction both of artists and in a great measure of their works. Still it was not the force of these outward events, to which art was long subjected in a constantly increasing degree, that mainly effected its downfall; it was rather the inward exhaustion and enfeeblement of the human mind, the loss of the elevated feeling that formerly inspired it, which caused the utter prostration of the fabric of ancient art.

3. Of the Subjects of the Plastic Art in Antiquity.

As the design of the formative arts in general is the imitation of actual nature, so the plastic art must choose the subjects of its representations from the circle of positive existences. It can only idealize, ennoble, or modify, according as it has to deal with historical personages or with those of religion and mythology. Subjects of the latter kind are always favorite ones among a people gifted with a genius for art; because in

them the creative faculty has freer scope for action and development. We will bestow on both classes a more particular consideration.

A. Mythological Subjects.

Before art properly so called existed among the Greeks, the poetical genius of that people had already called into being a vast treasure of myths; and these formed as it were the fruitful soil from which a rich and luxuriant growth of flowers of art must necessarily spring. The mystic nature of religion, though which the Divine Being, as something entirely different from humanity, admits only of indication and never of personification, had been thrust by poetry into the background; and when the plastic art sought to represent the gods, it found in them only idealized human beings elevated to the highest point of perfection. Although even this was quite impossible without an entirely peculiar conception, without inspiration, without an act of genius on the part of the artist, still there prevailed throughout the nation a general idea of each deity, that served as a test of the representation. If this idea was satisfied by the character of the artist's production, there was constituted at once a normal figure or type of the god, which was adopted and followed, though not with slavish literalness, by succeeding artists. All this is exhibited most completely in those deities which possess the most individual character; *i. e.* whose whole being cannot be reduced to a fundamental idea. These are the twelve Olympic gods, Zeus with his children and brothers and sisters.

1. The Twelve Gods of Olympus. *a. Zeus.* Zeus, the Jupiter of the Romans, was the father of all life in nature. Old descriptions make him to be the god who rules in heaven, upon the earth, and under the earth; but the conception of him embodied by artists is that of the gracious and mighty ruler of gods and men. This union of his qualities was adopted already by Phidias. To it belonged the arrangement of the hair rising high over the centre of the forehead and falling back like a mane on both sides, the forehead clear and open above and vaulted beneath, the deep sunk but wide open and round eyes, the fine and mild contour of the upper lip and cheeks, the full flowing and curly beard, the broad deep chest, and the powerful muscular development. The most important statue of the kind still existing, although by no means a work of the first class, is the *Verospi Jupiter* in the Museo Pio Clementino. Later artists occasionally deviate from this type, some of them giving to Jupiter a more youthful form with less beard, while others, giving to his youth an expression of anger though moderated and of martial vehemence, represent him as an avenging, punishing deity.

b. Hera. The female counterpart of Zeus was Hera, the Juno of the Romans. Her union with him, which is the source of nature's blessings, constitutes her essence, and at the same time makes her the goddess of marriage. As a lawful wife and powerful goddess she has attributed to her a proud and imperious character, which artists, however, knew how to soften. From very ancient times her principal attribute was the veil, and in the oldest statues it envelopes her completely. The colossal statue by

Polycletus wore a crown with the figures of the Hours and Graces in relief. In one hand she held a pomegranate as an indication of the great deity of nature, and in the other a sceptre on which perched a cuckoo. In the countenance of Juno is depicted an imperishable bloom and maturity of beauty, softly rounded, and commanding reverence without harshness. Her forehead, bordered with hair flowing down on each side, forms a gently arched triangle; and her full and open eyes look straight before her. Her form is blooming and completely developed, that of a matron. Her dress leaves only her neck and arms bare. The best extant statue, although of no particular excellence, is the *Barberini Hera* in the Museo Pio Clementino.

c. Poseidon. The god of the sea was Poseidon, the Neptune of the Romans; and to him the rivers and springs were sacred. The artistic form of this god is based on the fundamental idea of the poets, that, as ruler of a stormy element, he is like Zeus august and powerful but without his calm majesty of demeanor, while he exhibits something hard and rough both in his corporeal and mental movements. Hence he is represented in the most flourishing period of Grecian art with a rather slenderer figure than Zeus and more powerful muscles, which are rendered still more prominent by his posture. His countenance is angular in its character, with less calmness and repose in the features, and with wild disordered hair. There still exists a statue of Poseidon by Phidias in Carrey's drawing of the western pediment of the Parthenon, standing with feet wide apart and swelling veins in the breast. The modifications, however, to which the form of Poseidon is subjected even in the productions of ancient Greek art are so considerable, as to render it difficult to define its general character (see *pl.* 3, *fig.* 10, second figure).

d. Demeter. Connected with Poseidon appears Demeter, the Roman Ceres, the goddess of nourishing and sustaining nature, conceived of as a mother. This character, regarded in a purely human point of view, is also made the foundation of the artistic representations of the goddess; and the most beautiful embodiments of the idea are found in the school of Praxiteles, *viz.* in the gold and ivory statue in the temple of Eleusis. Demeter has a more matronly and motherly appearance than Hera; the expression of her face, the back part of which is concealed by the upper garments or veil thrown over her head, is gentler and milder; and her form, which is completely enveloped in clothing, appears stouter and fuller, as becomes the mother of all. Her attributes are a garland of corn-ears about her head, poppies and ears of corn in her hand, and a torch and fruit-basket. Not unfrequently she is seen enthroned; although it is as common to behold her walking over the earth and dispensing her fruits. A colossal statue of Demeter with her attributes complete is preserved in the Museo Pio Clementino.

e. Apollo. Phœbus Apollo was a god of health and of order, as opposed to a hostile nature and world. With respect to nature, he is the god of the more cheerful seasons of the year who drives away the winter; and as regards human affairs, a god who destroys oppressors and protects the

good. An ingenious symbolism represented the different aspects in which Apollo was regarded by the contrast of the weapons and the lyre, the bent and the unbent bow, &c. This god was a favorite subject with the great artists who immediately preceded Phidias. On the whole Apollo was then represented as of a more mature and manly form than afterwards, with stronger and stouter limbs, a rounder, shorter face, an expression rather earnest and energetic than amiable and charming, and mostly unclothed except when appearing as leader of the Muses. The slender shape, the longish oval head, and animated expression of the features were first given to Apollo by the younger Attic school. The statues of Apollo may be divided, according to the idea which predominates in them, into the following classes: 1. The Apollo Callinicus, who strides away with anger not yet entirely allayed from his vanquished opponent. Of this kind is the Pythian Apollo or *Apollo of Belvedere*, so called because it formerly stood in the Cortile di Belvedere (*pl.* 6, *fig.* 2). It was found near the harbor of Antium, and is of Lycian marble; it seems to have been copied from a statue in bronze, which is rendered probable by the entire disposition of the chlamys (short cloak). The left fore-arm and the fingers of the right hand have been supplied, and also some portions of the legs. 2. The Apollo reposing after battle, with his right arm thrown over his head and beside him his closed quiver. Of this kind is the beautiful *Apollino* in Florence. 3. The Apollo playing the lyre, who appears very variously costumed. A statue of this sort is in the Museo Borbonico. 4. As the Pythian Agonistes, clothed in a solemn and gorgeous costume and wearing the Pythian stola; such is the Apollo in the Vatican, after Scopas.

f. Artemis. The Diana of the Romans is the Grecian Artemis. Her character, like that of her brother Apollo, has two phases; she being sometimes regarded as a combating or hunting, and at other times as a life-giving and light-dispensing goddess. In the olden style she constantly appears in long and elegant drapery, which displays her full, blooming form. Afterwards, when Scopas, Praxiteles, and others had developed her ideal, Artemis appeared, like Apollo, slender and light-footed, with hips and breast without the fulness of womanhood; her face is that of Apollo, only more delicate, rounder, and less strongly marked. Her dress is a Doric chiton (tunic), usually girt high. The shoes of the huntress are those of Crete, which protected the foot all round. As a huntress, or as a combatant, Artemis in the better statues is represented sometimes in the act of drawing an arrow from her quiver, and sometimes as on the point of shooting it. The huntress Artemis is likewise guardian of wild beasts, and then she appears accompanied by a sacred doe. *Pl.* 4, *fig.* 7, is copied from a statue in Versailles, now in the Louvre, where Diana is represented as a huntress, slenderly and delicately but powerfully formed, with the horned doe by her side, and adorned with a stephana (fillet or wreath). As tutelary deity of the temple of Ephesus, Artemis appears in an Asiatic Amazon costume.

g. Hephæstus. A mighty god, the god of fire, was Hephæstus, the Vulcan of the Romans, a consort of Aphrodite; but he was not able to maintain his dignity either in poetry or in the plastic art. The former

makes him a skilful smith, but misshapen, limping, ridiculous, and a cuckold in his own house. The formative art represents him in the earlier times as a dwarf; afterwards as an active, laborious man, youthful (*pl.* 3, *fig.* 10, first figure), and robust; while the later schools gave him the appearance of a mature and bearded man, with a slight indication of lameness, which however does not deform his powerful figure, but rather makes it more interesting. He is recognised by his smith's implements and sometimes by a semi-oval Lemnian cap.

h. Pallas Athene. A pure and exalted being closely related to the god of heaven, appears Pallas Athene, the Minerva of the Romans, under the form of an Athenian maiden, who in the world sometimes diffuses light and warmth and wholesome life, and at other times destroys hostile beings. She is the goddess of energetic industry, of clear intellect, and the protectress of every profession and every person that undertakes and executes with discretion things of utility. Art, with which in the earlier times Pallas was an especial favorite, represented her in the ancient palladia with raised shield and brandished spear; although there were also statues in a tranquil and even in a sitting posture, with distaff and spindle. In the more advanced state of early Greek art, Athene appears constantly in a posture ready for combat, more or less advancing, and wearing over the chiton a stiffly folded peplos (richly woven robe) and a large ægis (coat of mail), which sometimes also lay over the left arm serving as a shield. The outlines of her body show but little feminine fulness in the hips and breast, and the legs, arms, and back are almost those of a man. The countenance has a peculiar cast, but the features are very harsh and ungraceful. Since the ideal of an Athene was perfected by Phidias (*pl.* 4, *fig.* 1) we discern in her a tranquil seriousness, self-conscious power, and clearness of intellect; her virginity denotes simply her elevation above all feminine weakness; she is too masculine to be capable of surrendering herself to man. The clear forehead, the long and finely shaped nose, the somewhat stern cast of the mouth, the large and almost angular chin, the not fully opened and rather downcast eye, the hair pushed back from the forehead and carelessly flowing down the neck, all agree with the character of this wonderful ideal creation. Later attempts to resolve this seriousness into grace, as in the Pallas of the Villa Albani (*pl.* 3, *fig.* 4), would only end in rendering her characterless. The modifications of the figures are closely connected with the dress. Pallas, in many statues of the perfected style, has a himation (toga) thrown about her, either so that falling over in front it covers merely the lower parts of the body and thus heightens the majestic impression of the figure, or so as to conceal both the left arm and a part of the ægis, and then the shield either rests on the ground or is wanting altogether; sometimes in this case the serpent is seen. The first mentioned style of drapery is displayed in the Pallas (*pl.* 5, *fig.* 6) found at Velletri in the year 1747, a grand statue 9½ feet high, now in the Louvre. The himation covering the arm and the ægis is found in the *Pallas with the Serpent* (*pl.* 3, *fig.* 5) which now stands in the new wing of the Vatican. Pallas the champion has an uplifted shield, no himation, and the whole figure exhibits a combative action and athletic form. Sometimes Athene

appears as a politically active oratorical figure, and without helm or ægis, as a peace-maker.

i. Ares. Ares, the god of war, the Mars of the Romans, is significantly placed along with Aphrodite in the twelve god system. He was too much an idea to become a favorite subject of the plastic art; and hence it is that, although some remarkable statues of Ares by Alcamenes and Scopas are mentioned, his plastic character is not well defined. A compact powerful muscular development, and short, often disordered, curling hair, seem in general to belong to the representation of this god. Ares has smaller eyes, rather more widely distended nostrils, and a less serene forehead than the other sons of Zeus; he has a more manly appearance than Apollo and even than Hercules, is bearded, although in later times also without a beard (*pl.* 3, *fig.* 2), and, when not represented entirely naked, only wears the chlamys. His arms are a helmet and sword; he is rarely provided with complete armor. Ares seldom appears in battle groups, and only as a giant-slayer on gems; but we often see him with Aphrodite, although this union of love and war is not always regarded as a frivolous adultery, but in a more serious sense. One of the most beautiful representations of this kind is the group in the Florentine Museum (*fig.* 2).

k. Aphrodite. Aphrodite, the Roman Venus, is represented by the artists of the most highly finished school with the natural forms of her sex. She is all woman, more so than Athene or Artemis. The ripe bloom of maidenhood is in general the degree of physical development in which the forms of her body appear. The shoulders are small, the bosom formed like a virgin, the fulness of the hips tapers away into elegantly shaped feet, which, little adapted to firm standing and walking, seem to betray a light and gentle gait. Her face appears delicate and rather long; and her languishing eyes and smiling mouth give it an expression of tenderness and exquisite sweetness. Her hair is elegantly arranged, usually encircled by a diadem, or restrained by a band, or else knotted into a krobylos. Here too the dress is connected with the essential modifications of the form. The completely clothed Venus, who however wears only a thin chiton, which enables one to divine more than it conceals, and who with a graceful movement of her right arm merely draws forward a little the upper garment which falls down behind, is derived from the Urania of the early artists. She was worshipped as Mother Aphrodite, had rounder and stronger forms, shorter proportions, and a more matronly character. From this widely differ the statues which, without the chiton, have only an upper garment thrown round the lower part of the body, and are further characterized by having one foot resting on a slight elevation. In these the goddess appears as a heroine; the forms of her body are firm, powerful, and slender; the bosom is less rounded than in the other statues; and the countenance furnished with more prominent features is full of pride and self-consciousness. This is Aphrodite the victorious, whether she embraces Ares himself (*pl.* 3, *fig.* 2), or bears his helmet or shield, or a palm, or, as her sign of victory, the apple. Of this sort is the *Venus Victrix* from the amphitheatre of Capua, now in the Museum of Naples (*pl.* 4, *fig.* 5), who rests her left

foot on a helmet. Very nearly related to this one in the drapery is the *Venus of Melos*, now in the Louvre (*fig.* 3), the work of an artist of Antioch on the Meander, if the inscription belongs to it. This statue was restored twice in antiquity.

Of greater fulness and roundness, although less powerful, appears Aphrodite at the Bath, her bosom covered with a piece of the drapery hanging round behind her, and still more soft and delicate in the hetæra figure of *Venus Callipygos*. On the other hand, faultlessly beautiful proportions are observed when the goddess is completely undraped, and the unsullied bloom of maidenhood forms a medium between Aphrodite the mother and Aphrodite the conqueror. The statue here becomes the complete symbol of female loveliness, brightened by the manifestation of natural shame into an expression of pure womanhood. Of this kind is the *Cnidian Venus*, who is just laying aside her garments, and the *Medicean Venus* of Cleomenes (*fig.* 2), which is very like the *torso* (mutilated statue) in the Dresden Museum (*fig.* 4) and the *Capitoline Venus* (*fig.* 6), with the same position of the hands, but less bent forward, with a more womanly shape, greater individuality in the features (perhaps a portrait?), a high head-dress, and near her a vase of unguents and a bathing-towel. This statue is in good preservation, even to the fingers. Such statues of Venus are found in almost all museums of consequence. Other attitudes, which show more movement and action, notwithstanding the peculiar charms which they disclose, have not the same pervading and uniform fulness of beauty. Of this class is the Venus girding on the cestus, putting on a shoulder-belt, defending herself, and above all crouching in the bath.' The finest is one of the last description in the Museo Pio Clementino (*pl.* 5, *fig.* 8), and in the Louvre there is a similar representation of the goddess. In groups Venus appears sometimes with Adonis, for instance holding him in her arms as he lies mortally wounded by the boar. Adonis is represented as a beautiful youth with powerful forms but almost boyish features, *e. g.* in a statue in the Museo Pio Clementino (*fig.* 9).

l. Hermes. Among the ancient Greeks Hermes, the Roman Mercury, stands in the circle of the powers that send up fruits and bounteous blessings from below; and this giver of all good the Greeks set up in the form of a post, furnished with a bearded head and a phallus, in all roads, fields, and gardens. But gradually he became an agronomic and mercantile deity of gain and traffic, and received the form of an active, powerful man, with a strong and pointed beard, long tresses, a chlamys thrown back, a travelling hat, winged shoes, and in his hand a caduceus which often resembles a sceptre. He is thus exhibited in all the older works of art; but the Attic school represents him as a gymnastically perfected youth, with a broad expanded chest, and slender but powerful limbs, clothed with the chlamys and travelling hat, and his hair cut short and not much curled. His features indicate a calm and acute intellect, and a friendly benevolence, which is also expressed in the gentle inclination of the head. As executor of the commands of Zeus he is often seen half-seated and already prepared to spring up again; sometimes in bronzes winging his way through the air,

or resting after a long journey with his arm leaning on a pillar. In accordance with this posture and these characteristics, Visconti explains also the statue which goes by the name of the *Antinous of Belvedere* (*pl.* 6, *fig.* 1) as a reposing Hermes. As a preparer of sacrifices and guardian of cattle Hermes often appears undraped and leading a ram, as on the Capitoline Puteal (*pl.* 3, *fig.* 10, the third figure).

m. Hestia. The household hearth, which forms the centre of domestic life and a regular worship of the gods, stood under the protection of Hestia, called Vesta by the Romans. She forms very appropriately, standing along with Hermes the god of sacrifice, the key-stone to the twelve-god system (*pl.* 3, *fig.* 10, the fourth figure). The form of this goddess, as sculptured by Scopas, was that of a woman in matronly costume, but without the character of maternity, quietly standing or sitting enthroned, with broad, powerful forms, and a serious expression in her simple features.

2. The other Deities. *a. Dionysus and his Attendants.* The worship of Dionysus, the Bacchus of the Romans, has retained more than the preceding the character of a worship of nature; and the circle of Dionysian forms, which in a manner constitute their own Olympus, represents the life of nature with its effects on the human mind, in various stages, sometimes noble and sometimes ignoble. The old Dionysus was a stately, majestic form, with a luxuriance of curling hair restrained by the mitra, a gently flowing beard, clear and blooming features, and rich almost effeminate clothing. It is not till the time of Praxiteles that the youthful Dionysus appears with bodily forms softly flowing into one another, which bespeak the half-feminine nature of the god. His features exhibit a peculiar mixture of happy intoxication and undefined longing. The mitra over his forehead and the vine or ivy wreath about his head produce an advantageous effect; the hair flows richly and in long ringlets over his shoulders; the body is entirely naked, at most with only a roe-skin thrown about it; and the feet are sometimes covered with the Dionysian cothurnus. An ivy-entwined staff ornamented with a fir-cone (the thyrsus) serves him as a support; he usually stands in an easily reclining posture, and seldom sits enthroned. A particularly beautiful statue of Dionysus is that of Versailles now in the Louvre (*pl.* 5, *fig.* 10), where the god leans on the trunk of a tree entwined with the foliage of the vine and brandishes the thyrsus. Somewhat different is the Bacchus in the Dresden Museum, who, as appears from the position, is expressing the juice of grapes into a cup (*fig.* 11).

To the attendants of Dionysus belong in the first place the Satyrs, who represent in a lower stage that life of nature which we have seen displayed by the god himself in its most elevated form. They are figures powerfully built but not ennobled by gymnastics, sometimes flabby, sometimes firm, with snub-nosed or otherwise ignobly formed countenances, goat-like ears, and bristly hair; in old age with a bald forehead; to which is added a little tail. Sometimes, however, the satyrs rise into very noble, slender shapes, and are hardly to be distinguished as satyrs except by their pointed ears.

Here too belong the Sileni, which are properly nothing but old and

bearded satyrs: still the name is confined chiefly to *one* satyr-form, which is usually connected with a wine-skin and itself has something of the appearance of one; in its drunken unwieldiness too it has more need of a support than the others, and this is afforded him sometimes by an ass and sometimes by satyr-boys. He is usually the instructor and fosterer of Dionysus's children.

Lower in the animal world stand the race of Pans and Panisks, representing the secret delight and dark horror of sylvan solitudes. Here too appears at first the human form characterized as Pan by the shepherd's pipe, the pastoral crook, the bristly hair, and sprouting horns; but the Praxitelian school brought the goat-footed, horned, and hook-nosed shape into vogue.

The female figures in the train of Dionysus offer less variety. Prominent among them is the graceful, blooming, ivy-crowned, and often richly dressed Ariadne. From the nymphs who exhibit no excitement of character, and the rarely occurring female satyrs, the Mænads (Thyades, Clodones, Mimallones, Bassarides) are distinguished by their revelling enthusiasm, dishevelled hair, and head thrown back, with thyrsi, swords, serpents, roe-calves, tympana, and fluttering, loose-flying garments.

To the Dionysian circle of beings belong also the Centaurs, as they seem perfectly fitted, by the unrestrained rudeness with which an animal life of nature is manifested in them, to join themselves to Dionysus. In the earlier times they were represented in front entirely as men, with a horse's body growing on behind; but from the time of Phidias the blending was effected more happily by joining to the belly and breast of a horse the upper part of a human body, whose cast of countenance, pointed ears, and bristly hair, betray an affinity to the satyr; whereas in female forms (Centaurides) the human portion shows more womanly and attractive shapes.

b. Eros. In temple-statues appears Eros, the Amor of the Romans, as a boy of graceful and developed beauty; but later art preferred the sportive, Anacreontic shapes of the childish form. As a still undeveloped, lively, and active boy he is seen, *e. g.* trying to fit the string to his bow, to carve his bow, &c.; and we have Erotes busily engaged in dragging off the insignia of the gods, taming wild beasts, and boldly and wantonly roving about among sea-monsters. Real children were also frequently represented in portrait-statues as Erotes (*pl.* 4, *fig.* 8). As a modification of the same idea we find Pothos and Himeros (Desire and Longing) represented in similar figures, and often grouped with Eros. Still more significant is the joining him with Anteros, the demon who enjoins reciprocal and avenges slighted love.

A very rich and important class of sculptures is furnished by the union of Eros with Psyche, the soul, which is represented as a maiden with butterfly-wings, and often simply as a butterfly; by which union is expressed the idea of Eros elevating the soul to a higher blessedness, and guiding it through life and death. Sometimes both Eros and Psyche appear without wings, as in the beautiful group copied *pl.* 5, *fig.* 7.

With the fable of Eros we connect also Hymenæus, who appears as a more serious and larger Eros, and is at the same time related to Comus, the leader of the joyous festal throng. A favorite subject of later art, when it had become effeminate and luxurious, was Hermaphroditus, a creation of artistic fancy rather than a symbol of nature, who sometimes stretches himself restlessly in sleep, as the *Hermaphrodite on a lion's skin* in the Florentine Museum, and that from the Villa Borghese now in Paris, restored by Bernini and reclining on a pallet (*pl.* 3, *fig.* 3), and sometimes stands wondering at his own enigmatical nature, or in various groups with Erotes and Satyrs.

The Charites (Graces), as social deities allied to Aphrodite, were sculptured in the earlier times in elegant forms, and sometimes lightly draped, although usually entirely naked. They are characterized by mutual embracing and joining of hands. In *pl.* 9, *fig.* 3, we give *Canova's Graces;* and in *fig.* 5, *Thorwaldsen's Graces*, which, although belonging to modern times, are not inappropriate here, as conceived in the genuine spirit of antiquity.

c. The Muses. The ancient artists recognised only three Muses, among whom they distributed the principal instruments of music; and it was not till Apollo became the leader of the Muses, that they appeared, nine in number, as draped figures, with fine intellectual countenances, and nicely distinguished from each other by expression, attributes, and sometimes by attitude. Still the parts performed by individual Muses are not so accurately distinguished in ancient art, but that many deviations may be discerned. Sometimes the Muses appear adorned with plumes; and this is explained by their victory over the Sirens, which are seldom represented as entirely human, but often as virgins with birds' legs and wings, or as birds with virgins' heads, and furnished with various instruments.

d. Gods of Health. Asklepius, among the Romans Æsculapius, receives in art most commonly the form of a mature man, of a Zeus-like but less sublime presence, with a mild, benevolent expression, his copious hair encircled by a fillet, a himation about his left arm and passing across under his heart, and in his hand a staff enwreathed with a serpent. But besides this there was a youthful bearded Asklepius. With him is grouped Hygeia, the goddess of health, a virgin of a particularly blooming appearance, who is usually giving drink to a serpent from a patera. Along with Asklepius is also frequently found Telesphorus, a little masked demon, the spirit of the hidden vital power.

e. The Primeval World. The Creation of Man. Representations of the older gods who are closely connected with the obscure origin of things, Uranus, Gæa, and the Titans, occur rarely or not at all as separate statues, although they find a place in reliefs and paintings. Kronos, however, makes his appearance, characterized by his veiled head and often also by his straight-hanging hair and sickle. Rhea acquired a greater significance, and Phidias sculptured her with the attributes of a mural crown, a timbrel, and a span of lions. Atlas, the Titanian bearer of the heavens, appears only, under an almost comical aspect, on reliefs and vase-paintings; and the fable

of Prometheus, especially of the fettered Titan, incited artists at an early period to its representation. The giants who figure as opponents of the gods are represented by the older artists as an exceedingly large-sized race; and it was not till afterwards that they were converted, as an indication of their earthly origin, into rock-hurling, snake-footed monsters.

f. The Lower World and Death. Hades, among the Romans Pluto, the ruler of the shadowy realm, is distinguished from his brothers, Zeus and Poseidon, by the hair hanging down over his forehead and by his sombre aspect; beside him sits enthroned Persephone (Proserpine) as the Hera of the nether world. These deities appear chiefly on funeral urns and sarcophagi; statues of them are very rare. Sleep and Death in the productions of ancient art are rarely and with difficulty to be distinguished; and thus is given that pleasing view of death and the grave, which the ancients were fond of seeking to preserve. The genius of Death is supposed to be found, and modern art has retained the symbol, in a winged youth with drooping head and hands crossed over an inverted torch; whereas Sleep for the most part appears with poppy-heads in his hand. Very beautiful is the representation of *Sleep as a boy* in the Dresden Museum (*pl.* 4, *fig.* 10). At his feet is a lizard, indicating the presence of the god of dreams. Morpheus is also found under the figure of an old man with wings.

g. Time. Of the representation of Kronos, who was also the god of Time, we have already spoken; as for the Horæ, who were warders at the gates of heaven and servants of Helios, and who mostly retained their signification in art, the succession of blossoming and ripening is their characteristic. The earlier artists represented only two of them, the later ones three or more. When four in number, they appear for the most part as the Seasons, and they are still more frequently represented as youths. A relief with dancing Hours (*pl.* 3, *fig.* 8) was formerly in the Villa Borghese, but is now in the Louvre in Paris. It is probably a copy from the masterpiece of Callimachus, the subject of which was *Lacedemonian girls* in the act of dancing.

h. Beings of Light. The Sun-god, if we except the Phœbus or Sol of the Romans, was held especially worshipped only in Rhodes. He appears with rounded forms and with rays streaming from his head, clothed in white, in his chariot, and guiding his steeds with the whip. Selene (Luna), in her usual form, is distinguished from Artemis, who also appears as the Moon-goddess, only by more complete drapery and by a veil which forms an arch over her head. Eos (the Dawn) appears either herself in a quadriga in magnificent form, or along with Helios as guide of the horses of the sun. Horoscopi play an important part on reliefs, for determining periods of time. Iris, from a luminous appearance in the sky, the rainbow, was converted in art into a light-winged messenger of the gods. She often appears on reliefs with the caduceus and a flower.

i. The Winds. Of the eight Winds only Boreas appears alone and independent on several reliefs, for instance on the coffer of Cypselus, where he has serpent-feet; and sometimes he is accompanied only by Zephyrus. All the eight Winds are sculptured in relief with their attributes on the

tower of Andronicus Cyrrhestes. The Harpies were properly dangerous wind-gusts, and appear usually in the form of winged women (*pl.* 1, *fig.* 13), and sometimes with more or less of the likeness of birds, as the myth leaves their shape tolerably undefined.

k. The Water. The attendant circle of Poseidon entirely resembles that of Dionysus, except that here the water and its inhabitants come into play. Their representations extend from the lofty forms of Poseidon, Amphitrite, and Thetis, through many intermediate gradations, to the fantastic shapes of the sea-monsters. A fine contrast is presented by the fish-tailed and satyr or centaur-shaped Tritons (sea and river gods) on the one hand, and on the other by the Nereids, for the most part in human form, in the earlier art lightly draped and afterwards undraped (graceful maiden shapes), whose pliant configuration is charmingly developed in manifold postures and windings. The water-gods appear, according to the importance of the streams, either as old men or as youths with urns, cornucopiæ, and rushes as attributes, which are further modified by the nature of the country and the condition of the nations that inhabit it. So the Nereids of the Sea correspond with the Naiads of the rivers, which are represented as half-clothed maidens frequently holding large shells.

l. The Vegetation. The gods of the groves and fields are for the most part of Roman origin. To these belong Silvanus and Vertumnus, although our museums contain no statues of the latter. Among the attendants of Silvanus are the Fauns; and while he appears as an aged or at least a mature man, they are slender but powerfully formed youths with short curly hair and cheerful countenances. They are the guardians of the woods, appear usually naked or at most with only a beast's skin, in general a panther's or lion's hide, thrown loosely about them. *Pl.* 6, *fig.* 3, is copied from a beautiful statue of a Faun at rest leaning against the trunk of a tree. Flora, the goddess of spring and of flowers, seems to have been formed by the Romans from the Grecian Hora of spring. One of the first statues of Flora is the *Farnese Flora*, now in the Museum of Naples (*pl.* 3, *fig.* 6); although only the torso is ancient, the head, the extremities, and the attributes being modern restorations. The Pomona of the Romans is the Autumnal Hora of the Greeks; and Priapus is properly only a guardian of fields and gardens.

m. Human Pursuits and Conditions. The number of personifications and deifications, bordering on allegory, of human qualities and relations, as also of representations of abstract ideas, is very considerable. But all these representations, with few exceptions, are either male or female figures of various ages, which can be distinguished from one another and accurately determined only by means of the attributes assigned to them; or also such allegorical figures are based on the representations of olden deities with such slight modifications as suffice to give them an individual character.

3. THE HEROES. The fixity and definiteness of individual characteristics, which we have found produced in Grecian works of art not only by means of attributes and treatment but also by the shape and configuration of the body, were extended by ancient artists also to the heroes, at least the

principal of them. Now, however, we can recognise so definitely very few of these heroes, in fact none scarcely but Heracles; for instead of the numerous marble and bronze statues, the productions of great artists, which antiquity possessed, we have nothing scarcely but the reliefs on sarcophagi and vase paintings, which latter are too light and sketchy to exhibit even a portion of those characteristics which the Greek artists knew how to stamp upon their masterpieces. It is, therefore, only by the contents of some large representation that we can ascertain the personages represented; and even here there is too often a choice between different cycles of heroes.

a. Heracles. Heracles was a national hero of the Greeks, and in him the heroic ideal is expressed with the greatest vividness. The characteristic feature of Heracles, strength steeled and proved by exertion, was expressed even in the earliest representations, but was developed in the highest degree by Lysippus and Miron. Even the youthful Hercules displays this concentrated energy in the immense strength of the muscles of his neck, the thick short curls of his small head, the small eyes, the form of his limbs, and the breadth and prominence of the lower part of his forehead. But his character is still more forcibly exhibited in the victor of fierce combats, the toil-laden hero of mature age as represented with especial predilection by Lysippus. The swelling muscles rendered protuberant by perpetual toil, the powerful arms, thighs, legs, breast, and back, and the serious features of his resolute countenance, produce an impression which cannot be effaced by transitory repose. For the twelve labors of Heracles, which were very frequently sculptured on reliefs, there were soon established certain modes of representation, which varied according to time and place. The strictly warlike exploits of Heracles became less generally the subjects of representation by the plastic art; and he appears for the most part in the costume introduced by Hesiod, where the lion's skin, the club, and the bow form the ordinary accoutrements of the hero. Another phase of the character of Hercules is displayed in his relation to Omphale, where the hero spinning in female attire is opposed to the heroine in her nudity armed with the club and lion's hide. In his relation to his son Telephus, who was suckled by a hind and found again, artists, with whom it was a favorite subject, especially in the time of the Antonines, must have followed other sources than the usual mythological legend. Of the statues belonging here, of which there is no inconsiderable number, we will particularize only the *Farnese Hercules* in repose (*pl* 5, *figs.* 1 and 2), of which we have already spoken (p. 21); the *Combat with Antæus*, a magnificent marble group in the Florentine Museum (*pl.* 3, *fig.* 1); and lastly the *Hercules with the boy Telephus on his arm* (*pl.* 6, *fig.* 5), a wonderfully fine statue which is found in the Museo Pio Clementino, and is in excellent preservation. Another style of representation is seen in the Hercules in careless, sportive ease among the attendants of Dionysus. A Hercules in this state of easy repose was represented by the statue of which there remains to us the world-renowned *Torso Belvedere*, whose posture perfectly agrees with that of the Hercules reposing among the satyrs. This torso is copied in *pl.* 5, *fig.* 3. Hercules seems here to have leaned on his right arm in a sitting posture;

the left arm was thrown over his head; and a happy feeling of comfort is diffused over all the muscles of the hero's body, without lessening the impression of immense power.

b. The other groups of Heroes. The hero-figure of Theseus, even before the time of Phidias, was fashioned after that of Hercules; he received however a conformation of body less compact and especially indicative of activity and skill in wrestling, a more open and graceful cast of countenance, and short, curly, but less crisped hair. His costume is the lion's hide and club, sometimes also the chlamys and petasus (hat). At a much later period, Hippolytus, allied to Artemis, had given to him by artists the form of a slender and noble youth. The Bœotian heroes are designated by the covering for the head worn in their country. Winckelmann thought that he recognised Jason's graceful and lofty hero-form in the statue of the sandal-tyer in the Louvre known by the name of *Cincinnatus* (*pl.* 5, *fig.* 12), but there is so little of the hero in this admirable statue, that the contented husbandman is rather to be sought in it than the bold leader of the Argonauts. Moreover, according to ancient descriptions, a leopard's skin seems to have pertained to his costume. Medea appears sometimes in a simple Grecian garb, and sometimes in oriental drapery, in a sleeved coat (kandys) hanging over the under dress, with the strife of passions expressed in her countenance.

Among the Thessalian heroes Peleus alone is deserving of notice in art, in consequence of his relation to the Nereid Thetis, who is usually striving to defend herself against her ravisher. Achilleus was represented by the ancient artists with hair reared up like a mane, nostrils expanded with courage and pride, and a slender but thoroughly noble and powerful form of body. His attitude is heroic, with one leg somewhat advanced and the himation lightly falling over its thigh; when seated, as in some gems and reliefs, the himation falls in the same manner as with Zeus. Meleager, the hero of the Calydonian hunt, is represented in a famous statue in the Museo Pio Clementino (*pl.* 6, *fig.* 8) as a slender, powerful youth, with a broad chest, stout limbs, curly hair, and a chlamys thrown back and wrapped about the left arm. He is unmistakably designated by the boar's head on which he leans. A very fine, perhaps the finest statue of Meleager, was found at Marinella in 1838, and is now in Berlin. With Meleager appears Atalanta, in a shape resembling Artemis. The Thracian Orpheus appears as an inspired lyre-player, at first in Hellenic costume, and afterwards in a Phrygian garb.

Of the heroes of the Peloponnesus, Bellerophon is celebrated through his connexion with Pegasus and the Chimæra. He appears as a slender, heroically bold youth, usually naked, either riding Pegasus or vanquishing the Chimæra, though sometimes thrown off, on reliefs and gems. Perseus is usually figured like Hermes, and in later times is splendidly armed. The Dioscuri, who always retained very much of their divine nature, exhibit a perfectly unblemished youthful beauty, a slender and powerful shape, and, as an almost never failing attribute, the semi-oval hat, or the hair lying close to the back of the head and projecting in thick curls about the forehead and temples, as in the colossal group on Monte Cavallo.

Besides the heroes, there appear also in Asia effeminate figures of mythological importance: *e. g.* the boy-favorites of Zeus (Ganymede) and of Heracles (Hylas); and also the Amazons, who have the character of Asiatics both in costume and accoutrements, and are distinguished by a certain softness of form; although the statues, as *e. g. the Capitoline Amazon* (*pl.* 3, *fig.* 7), and the reliefs mostly adhere to the simple, light drapery, and the strongly rounded forms of the limbs, which were given to them in the period of Polycletes.

B. Subjects from Human Life.

1. Of an Individual Kind. *a. Historical Representations.* In the domain of ancient art historical representations are much less frequent as pictures of individual events than as a conception of the subject in its general features. In Greece, moreover, painting was oftener than sculpture directed to the celebration of historical occurrences, victorious battles, or the lives of sages and poets. Yet there are a great number of wonderful and surprising stories of great filial devotion, love, and the like, as that of the Catanæan brothers, of Hero and Leander, and some others, which have acquired the prerogatives of myths in the formative art almost as completely as in poetry. Among the Romans these historical representations were more frequent, the events being not merely mythically alluded to but plainly depicted on triumphal arches and columns. The apotheoses belong rather to the department of allegory than to that of historical representation. Ancient art manifests great skill in portraying and discriminating between the different races of mankind; and on the reliefs it is easy to distinguish the Dacians, Sarmatians, and Germans from the Romans.

b. Portrait-Statues. Portrait-statues, medals, &c., originated in the desire to honor the victors in the sacred games; but as republican spirit decayed their number was multiplied by political ambition to an enormous extent. They were mostly of brass, rarely of marble, and often only busts or medallions. It was not till after the busts that portrait-statues came into vogue. At first portrait-images were formed of distinguished individuals of earlier times in the same manner as of heroes in accordance with their known character, their writings, &c., as *e. g.* the head of Homer (*pl.* 3, *fig.* 12). At the time when learning was cultivated, the portraits of authors, and particularly of philosophers, formed a special branch of art, as they formed the ornaments of museums and libraries. The artists displayed astonishing talent in portraying the peculiar branch of study and the literary character of these personages. Of the philosophers we can identify with certainty the busts of Heraclitus and Anaxagoras, Pythagoras, Thales (*fig.* 15), Periander (*fig.* 13), Socrates, Plato, Carneades, Theon of Smyrna, Aristotle, Theophrastus (*fig.* 14), Antisthenes, Diogenes, Zeno, Chrysippus, Posidonius, Epicurus, Methrodorus, and Hermarchus. Of the poets we have Alcæus, Sappho, Anacreon, Stesichorus, &c.; of orators, Isocrates, Lysias, Demosthenes, Æschines (*fig.* 16), Leodamas, and many others. Of physicians we possess Hippocrates, Asclepiades, and others. Many authentic busts too of Athenian statesmen have been preserved, of princes perhaps only Alexander.

2. Representations of a General Kind. *a. Religious Acts.* Subjects taken from every-day life very frequently have reference to the worship of the gods and the rites and games connected therewith; but all the representations of this class consist chiefly of reliefs or of paintings. To these also belong vases, libations, offerings, the decking of the statues of the gods, sacrifices to the dead, &c. Persons engaged in the service of the altar, especially when their functions introduced a significant and pleasing attitude, were also represented in statues, and frequently in an established style appropriated thereto, as the Canephoræ, &c.

b. Agones. Plastic representations belonging to the domain of gymnastics, and of which the Greeks especially were very fond, constitute an entire class of themselves. The greatest number indeed, that forest of the statues of victors which adorned the temple courts of Olympia and Pytho, are lost to us; but still there are many remains, consisting of marble copies, reliefs, vase-paintings, and gems, from which a tolerably complete cycle of such representations can be collected. Short curling hair, robust limbs, powerful forms, and comparatively small heads, characterize this entire class of figures. The leading aim here was to represent with perfect truth the particular conformation of the body and the characteristic movements of the different kinds of combat; although the athletæ were often sculptured in general attitudes, such *e. g.* as that of anointing the body, praying for victory, &c.

Horse and chariot races were also frequently represented by the Grecian artists with life and spirit; and the great frieze in the interior of the Parthenon, which portrays the Panathenæan festival, and of which we have copied a small portion (*pl.* 3, *fig.* 9), shows how admirably skilled were the Grecian artists in displaying the horse in all his attitudes. The Romans too were fond of seeing their circus games depicted, especially in mosaic; and the combats of the gladiators gave occupation at least to the subordinate arts of painting and pottery in the way of paintings on walls and on vases. The same too was the case with representations of the art of dancing and of musical contests. Only those branches of the formative art which, neglecting severe principles, imitate life extensively, as vase-paintings, miniatures, mosaics, &c., reproduce scenes from the stage.

c. War. The ancient triumphal monuments, *e. g.* Trajan's Column, the triumphal arches, &c., the sculptures on which relate to success in war, furnish us the best opportunity for studying the mode in which the Romans treated these subjects. Even sea-fights, according to the style of the ancients, of making the human figures everywhere prominent and reducing the inanimate masses into mere accessories, could be compressed into a comparatively small space. Statues of combatants in interesting postures may not unlikely have belonged originally to large historical groups, and have been afterwards executed as separate works. To this class we would assign both the famous *Borghese Gladiator* (*pl.* 5, *fig.* 4), and the *Dying Gladiator* (*fig.* 5), two of the finest statues that have come down to us from antiquity. The Borghese Gladiator is of marble, little above the size of life, and, according to an inscription upon it, the work of Agasias, son of Dositheos of Ephesus. The statue is now in the Paris Museum.

d. The Chase and Rural Life. Representations of the chase, especially of the boar-hunt and hunting the hare, are very frequently found in ancient reliefs and paintings. The occupations of rural life, however, are seldom represented by immediate imitation of the reality, since the occasion for depicting them was frequently furnished by the worship of Ceres and Bacchus; at all events we almost always find mythological figures interwoven in representations of this sort. Still in the domain of ancient art there are not wanting delineations of rustic simplicity and sturdiness; while in youthful figures this rustic character acquires an expression of harmless innocence and naïveté. A representation of this sort from rustic life of truly touching simplicity is seen in the *Boy extracting a Thorn from his Foot*, in the Capitoline Museum (*fig.* 13), a bronze statue of the size of life; *the Boy wrestling with a Goose* (after Boethos's statue in bronze), especially the group in the Capitoline Museum (*pl.* 6, *fig.* 6), also belongs here. Reliefs and paintings on houses designed to announce the professions of the occupants gave occasion for manifold representations of handicrafts and trades. Frequently the subject was taken from domestic and married life, as for instance social banquets, which on sarcophagi, &c., appear as feasts of the dead, the feasters being often represented as gods of the lower world.

4. The Middle Ages.

A. From the Decline of the Plastic Art in the 3d Century down to the 13th Century.

The decay as well as the flourishing growth of the arts and sciences has ever been dependent on those two mighty sources of all movement in the moral world, religion and the form of government. Sometimes one, sometimes the other, determines the fate of the arts; but generally speaking the influence of both causes has operated so uninterruptedly from the very birth of the arts down to our own times, that their history is almost inseparably connected with the history of religious opinion and of political revolutions. Accordingly the mighty revolution which accompanied the downfall of the Roman empire and the introduction of an entirely new religion could not fail to exercise an influence upon art and its forms, and this all the more as even under the first emperors a decline of correct taste had become perceptible. Even the apparent restoration of the arts under the Antonines was of no duration; it was a last fleeting effort, like the sudden flashing up of a candle before it utterly expires.

In the time of Constantine the Great, art was already at so low an ebb and there was such a dearth of able artists, as we have already had occasion to observe, that in order to adorn with sculptures the triumphal arch which the senate and people erected to the emperor after his victory over Maxentius, they were forced to take the sculptures from Trajan's arch and attach them to that of Constantine, so that only a few reliefs were made new which have reference to the deeds of Constantine. But these last are as inferior to the others in composition as they are in drawing and execution. One of the

best productions of that time is a relief now preserved in the Capitoline Museum. It is known by the name of *Pietas Militaris* and represents warriors transporting a wounded companion in arms from the field of battle (*pl.* 7, *fig.* 1). Here belong also some statues of Constantine and his sons; but these also exhibit the decline of art, which now advanced with gigantic steps, as is shown by the contracted stature and disproportionate breadth given to the human figure.

This decline of the arts, however, did not take place so suddenly as some endeavor to maintain; the decay in fact was very gradual, so that it was not till the end of the fifth century that they went so far as to patch together new buildings out of ancient fragments. In Rome especially it was during the sway of Pope Gregory the Great that this deterioration of art gained the ascendency; although the bishops in the provinces had been in the practice for several decenniums of pulling down the temples and building churches and basilicas out of them, while they eagerly destroyed the statues of the gods with true fanatical rage.

As soon as Constantine the Great had resolved to rear a new Rome on the site of ancient Byzantium, not only were the best artists summoned to Byzantium from Rome, but also the finest and most celebrated works of art throughout the whole extent of the Roman dominion were carried off to the new capital; and when its dedication took place in the year 330, men beheld with admiration in the streets and public squares of Byzantium, no longer as objects of idolatrous veneration but simply as creations of art, the statues of the Pythian Apollo and Apollo Smintheus, the tripod of the Delphic oracle, the Muses of Helicon, the famous statue of Pan, the Cybele, said to have been set up by the Argonauts on Mount Dindymus, the Athene from Lindus, the Amphitrite from Rhodes, and countless other productions of genius; though these were afterwards destroyed by the Christians as idolatrous images deserving no better fate, and were partly buried in fragments under the floors of churches, in order that they might be as it were trodden under foot by the professors of the true faith. But we need not be astonished that, in spite of this fanatical zeal for destruction, so many statues of the gods have been preserved to our times; for the adherents of the old religion buried these images, in order to preserve them from destruction, from which cause they are found even now in places where no temple or altar ever stood.

But Constantine did not content himself with merely collecting works of art; he also caused others to be executed. To these belong the above mentioned portrait-statues, which were set on high pillars, and a fountain, whose plastic ornaments had reference to the Christian religion. Above appeared Christ as the good shepherd, and another bronze group represented Daniel in the lions' den, a subject which in succeeding times was often treated by sculptors. Constantine also caused a statue to be executed of Athalaric, king of the Goths.

Among the many churches which Constantine built in his new capital was the Church of Peace, designed to be the emperor's burial-place, which was afterwards enlarged by Constantius and dedicated to St. Sophia. He

adorned it on the outside with 450 statues, which doubtless had no reference to religion, as the use of sacred effigies was not introduced in the early times of Christianity. This church was afterwards burnt down; and when Justinian caused it to be rebuilt, there were found on one side buried in the rubbish more than seventy statues of Greek divinities and a few of Christian emperors, which statues were then set up again in different parts of the city.

In the reign of Julian the Apostate the heathen temples were restored and built up again, and new statues of the gods erected. Taste was not yet utterly extinct; for artists were still accustomed to visit Elis for the purpose of copying Phidias's statue of Jupiter Olympius. After Julian's early death nothing scarcely was done for art; and Theodosius the Great was the first who caused a few plastic monuments to be erected. Among them were two columns resembling Trajan's Column. One of them, placed in the Tauric Forum, bore reliefs relating to the emperor's exploits against the Goths and Vandals. Bajazet caused it to be totally destroyed. The other column is still standing, but is so surrounded by the buildings of the Harem as to be inaccessible. Gentile Bellini made a drawing of it in the time of Mohammed II., and it was described by Menestrier. Many statues in short were erected to Theodosius, his wife, and his son, but just as many to charioteers, actors, and buffoons.

The destructive zeal of the Christians increased with time. Not content with demolishing all the statues, paintings, and mosaics of mythological import, they also attacked other objects of art. Everything pagan was for the most part utterly destroyed; but if a thing was put to some use, it had first to be purified. Thus Harald, king of Denmark, by the advice of abbot Hermold of Languedoc, had two statues of Jupiter and Neptune melted down, to cast church vessels out of them. When materials were needed for building new churches and basilicas, heathen temples and even profane edifices were pulled down to furnish them.

The fifth century was the most fatal of all for the remains of ancient art and civilization, for then the barbarian hordes invaded and laid waste the Roman provinces. The first were the West Goths under Alaric, who captured Rome in the year 409, but spared the works of art. Then followed in the year 437 the persecution of the Catholic Christians by Genseric the Arian. In the year 445, under the reign of Pope Leo I., Attila, who called himself the Scourge of God, invaded Italy; and in 455 Genseric set fire to Rome, on which occasion the palace of Sallust with all its treasures of art perished in the flames. The imperial palace was plundered; and a ship laden with bronze statues foundered on her voyage to Carthage. And when, in the year 476, under the reign of Pope Simplicius I., Odoacer, king of the Heruli, dethroned the Roman emperor Augustulus and put an end to the Western Empire, many other treasures of art were sacrificed. It is hardly necessary to say that in such times artists created nothing new. All that was then accomplished in the department of sculpture was confined to reliefs and a few insignificant portrait-statues. Especial pains were taken in adorning the graves in the catacombs; and if we wish to behold the remains of art of that period, we must betake our-

selves thither. Although here and there in these works, which for the most part are the productions of artists of an inferior stamp, we meet occasional echoes from the better periods of art, as *e. g.* in the reliefs, *pl.* 7, *fig.* 2, copied from a Christian sarcophagus in the cemetery of the Vatican, which represent the restoration of the dead to life according to the vision of the prophet Ezekiel; still the great majority of them are weak in invention, coarse in execution, and generally faulty in drawing.

It was not till the year 493, when Theodoric, king of the East-Goths, possessed himself of the supreme power in Italy, that bounds were at length set in earnest to the rage for destruction; while Theodoric himself expended large sums not only for preserving but for restoring the monuments of antiquity and the objects of art. When at that period an ancient bronze statue was stolen at Como, the strictest search was instituted, and the thief when discovered put to death. Many considerable structures were reared by Theodoric in Ravenna, Naples, Pavia, &c.; and both during his lifetime and in the reign of his daughter, queen Amalasunta, several statues were erected to him, in one of which, at Naples, was applied the invention of a particular kind of mosaic, the whole statue being composed of small colored stones. The cement however did not hold, so that in a few years the statue fell to pieces.

In the year 531, in the reign of Justinian, the church of St. Sophia in Constantinople was consumed by fire, when innumerable sculptures perished; and about the same time Belisarius destroyed all the aqueducts of Rome. A few years later (A. D. 537), when Rome was again besieged by the Goths, at the assault on the Mausoleum of Hadrian (now the Castle of St. Angelo), the defenders broke in pieces the statues which adorned it and hurled them at their assailants. Under the dominion of the Longobards, which began with Alboin in 568 and ended with Desiderius in 774, as the native rudeness of this people begot in them an utter indifference towards the fine arts, a number of the precious relics of ancient art were again suffered to perish. Yet new works were produced, and queen Theodelinde in particular caused many sculptured works to be executed; of these there still remains a bas-relief on the gate of Monza, representing the queen with king Agilulph, which however affords a very melancholy picture of the then state of art. In Pavia also, in the church of St. Michael, sculptures of that period are extant.

Art sustained irreparable losses through the reign of Pope Gregory I., who caused numberless statues to be destroyed, and of Pope Sabinian I., under whom any one at pleasure took possession of the existing statues, and if he could not carry one off entire, he took at least the head away. Pope Honorius I. (A. D. 662) built much and caused a good many works of sculpture to be executed. Paltry and destitute of all artistic value as are the works of those times, of which a large number have come down to us, contemporary writers are lavish in the praises they bestow upon them. Nor is this to be wondered at; for in a time of universal ignorance, when an acquaintance with the art of writing was a rare accomplishment, the production of a painting or a piece of sculpture, however poor its quality,

seemed a glorious performance, and this all the more as in the East during the first centuries of Christianity, the making of sacred images and sculptures was strictly prohibited by the teachers of the church. Nevertheless art has ever found in the doctrines and traditions of religion its best and most numerous subjects, and its chief stimulus and support.

In the year 662, according to others 692, the Concilium Quinsextum was held at Trullo; and then it was decreed in the 82d canon, in opposition to the decrees of previous councils, that in future the lamb should not be depicted on the cross, but Christ in the human form. From that epoch commences the use of crucifixes in painting and sculpture; and in the earliest ones Christ appears always clothed, with a royal crown on his head, and fastened with *four* nails to the cross. The use of *three* nails did not arise till the time of Cimabue, who is regarded as the restorer of painting.

Shortly after, namely in the year 723, began the systematic attacks on images of the Iconoclasts which set the eastern and western churches at variance, and led throughout the greater part of the East to an utter destruction of the sacred monuments both of painting and sculpture. Now too began a time when the persecution of the works of art was extended to the artists themselves: for in the year 825 Michael II. issued repeated edicts against the adoration of images; and his successor Theophilus caused the holy figures in the pictures still extant to be painted over with birds, flowers, and ornamental foliage in the Arabian taste, while he threatened those artists who engaged in the representation of sacred subjects with severe punishments, and threw them into prison. But in the year 866 the use of sacred images began again and spread so rapidly that each military cohort carried with it the image of its saint in a small chapel mounted on two wheels.

Many writers are of opinion that the crusades proved of great benefit to the arts in the west and were the chief cause of their resuscitation. This supposition is based chiefly on the foregone conclusion that in Italy art was utterly extinct; so that its first principles had again to be brought from the East, where the splendor of the imperial court had constantly preserved it from destruction. To this assertion, however, we cannot assent. The crusades not only depopulated the country, but they also impoverished it; for the crusaders took immense sums of money with them out of the country. Of course, the artists, whose occupation flourishes when peace and comfort prevail, had to suffer. Nor is it true that any important works of art were brought by the crusaders into the West to serve as models: all the booty taken consisted of gold, silver, or precious stones, which, without regard to artistic value, were divided amongst the warriors, and by these again for the most part squandered away. At the taking of Jerusalem, in the year 1099, Tancred, it is true, had the good fortune to attack and carry the mosque of Omar, which was filled with jewels, and gold and silver lamps and candlesticks, and also statues, taken from former Christian churches; but all these were the work of Christians in the East, and consequently dated from a period in which taste and consequently the arts

were already at a very low ebb. Hence the crusades were not directly of any advantage to art; but indirectly they were, as we shall soon see.

Although now and then a Genoese or Venetian vessel may have brought from the East works in alabaster, porphyry, or verd-antique, and perhaps also occasionally a statue or a reliquary, such insignificant matters can hardly have exerted any influence on the revival of the arts. But the wealth which the cities of Italy acquired through their favorable position for commerce, and which doubtless was increased by means of the crusades, may well have fostered in the citizens the love of splendor and consequently a taste for art. The bishops, abbots, and monasteries, moreover, had enriched themselves during the crusades by the acquisition of lands sold or pledged to them, and by real or falsely authenticated gifts from persons who had lost their lives in the East; and these vied with the rich trading cities in their love of splendor, and in the munificence with which they adorned their palaces and churches with marble, works of sculpture, paintings, and mosaics. In this manner the crusades were indeed the indirect means of elevating the arts; the direct causes, however, which produced this effect were the industrious pursuit of trade and the astuteness of the clerical order, who knew how to turn the circumstances of the times to their own advantage.

Notwithstanding the degraded condition of the plastic art in the 9th and 10th centuries, the fondness for beauty and for embellishment which is inherent in man extended the practice of art over every part of Europe, and we perceive its feeble beginnings in those buildings of the period which have survived to our times. For although Charlemagne caused marble and columns to be brought from Italy for his structures at Aix-la-Chapelle, there are also statues extant which were executed for him in Germany.

But with the 11th century there commenced a period in which German art outstripped that of all other countries; and as in those times German architecture attained a high state of perfection in the short space of two centuries, and German architects practised their art in Italy, Spain, France, and likewise in the north of Europe, so too sculpture arose here from its slumber earlier than in Italy. For while in Italy it was not till the year 1250 that an advance was effected by the exertions of Nicolas of Pisa, a better style of art had been already exhibited in Germany in the reliefs of choir-screens in the church of Our Lady at Halberstadt finished in the year 1200, the monumental effigy of the abbess Agnes at Quedlinburg of the year 1203, and the bas-reliefs in the church at Gernrode.

B. From the Revival of Art in the 13*th to the* 17*th Century.*

If in the 12th and 13th centuries the art of sculpture made a more rapid advance in Germany than anywhere else, and if notwithstanding we possess no grand and independent works of statuary executed by Germans of that period, the cause of the phenomenon is to be sought in the intimate connexion in which sculpture then stood with architecture. If we consider the façade of a dome of those times, we behold, it is true, an abundance of plastic figures; they have, however, even when very carefully finished, no

individual significance, but are intended to act merely as parts of a whole. The plastic art had become as it were the handmaid of architecture. As with the sculptures of the façades so too with the ornaments of the high altars of German churches, especially those of the 15th century. Here too the statues of the shrine and the statues of the open and lofty tabernacles were merely designed to contribute to the effect of the whole, which lay mainly in the architecture. When the age of virtuosoship arrived, and men recognised the statues of a master, sculpture retreated more from the fronts to the interiors of churches, the better to satisfy the increasing tendency to a fond elaboration of details. Still the architectural idea remained predominant. We find the gold-embroidered stole and the bishop's crosier adapted to the architectural style; the censers are little silver chapels, the pyx is a little golden steeple, and the reliquary a little church of gold plate, whatever may be the number of statues introduced. If we cast a glance at the style of the figures of the 13th century produced by German art, we perceive that the measured severity of the Roman style retained as its basis has yielded to a rich subjective heartiness of feeling, and that especially in Saxony a school was produced where excellence consists less in an adequate study of nature and a skilful representation of movements than in a pious adoption and genial use of the means which the ancient works of art placed in their hands. The human figures lose their cold, rigid character, and assume a graceful demeanor; and the features have a soft and amiable expression. The shoulders, however, with the arms fitted close to them, are often made too narrow; the hands too appear sometimes awry, and the stomach rather too prominent. The drapery is arranged in long, waving folds.

Nicolas of Pisa, born in the beginning of the 12th century, distinguished himself both as sculptor and architect, and is regarded, as we mentioned above, as the reviver of the plastic art in Italy. It is true that in the manner of his composition he did not differ from his predecessors and contemporaries; but in his forms he copied the antique and that so closely, that he made use in his works of figures from ancient sarcophagi which he found in his native city, and thus reproduced *e.g.* a Juno or Cleopatra as the Virgin Mary, a Plato as Joseph, &c. Although his figures are rather short in their proportions, they are incomparably superior in every respect to the productions of the immediately preceding period. His chief works date about the middle of the 13th century, *e.g.* the *Descent from the Cross* at San Martino in Lucca, 1240; *The Pulpit* in the Baptistery of Pisa, 1260; and that in the cathedral of Siena, 1266. He died in the year 1275. His son, Giovanni da Pisa, boldly followed the path struck out by his father; but he deviated from it in many respects, since, instead of the placid beauty of antiquity, he strove more after expression and character, and fell not unfrequently into exaggeration and distortion. One of his best productions is a *Virgin with the Child Jesus* (*pl.* 7, *fig.* 13) which was set up in 1298 at the southern side door of the Florence cathedral. She is of life size and holds in her right hand a flower, the sign of the Maria del Fiore, the tutelary patroness of this church, and, in allusion to the arms of Florence, a

red lily on a silver field. Other works of Giovanni da Pisa which are highly spoken of are the great fountain in Perugia, 1264; the pulpit in the cathedral of Frezzo, 1286; the pulpit in St. Andrea at Pisa, 1301, &c. He died in 1320. His best pupil was Andrea Ugolino, also called Andrea da Pisa (born 1270, died 1345), who accomplished much for the perfection of his art. He wrought in company with Giotto, for whose buildings he furnished the sculptures. With his son Nino the Florentine school of sculpture attained its most flourishing condition towards the close of the 14th century. Among the best pupils of Nicolas and Giovanni da Pisa are reckoned also Agostino and Angelo de Senis (of Siena), who ornamented the tomb of the bishop of Arezzo, Guido Tarlati de Pietra Mala. Theirs is the statue of a bishop copied from this monument on *pl.* 7, *fig.* 3. Giovanni Balducci, who flourished about the year 1340, belonged also to the best masters of the Florentine school and was born in Pisa. Among his many works that to which his fame is principally owing is a mausoleum or shrine of St. Peter the Martyr for the church of San Eustorgio in Milan. We have given a view of this work in *fig.* 4, and in *figs.* 5, 6, 7, and 8 copies of four of the caryatides on a larger scale. Of these caryatides there are eight: those in the rear represent the four cardinal virtues; those in front are the three godly virtues, Faith, Hope, and Charity, and likewise Obedience which bears the yoke, the other figures also being furnished with their appropriate attributes. The body of the monument resting on the caryatides, which contains the shrine, is decorated with eight reliefs representing scenes from the legends of the saints. Here we behold the saint stilling a tempest, visiting the sick, and exposed to view in state after his death. About him stand figures of apostles and fathers of the church. The pyramidal cover is adorned with reliefs and statues of angels; and above it is an ornamented addition containing the figures of the Holy Virgin, St. Dominic, and St. Peter the Martyr. On the apex is Christ between two angels. The entire monument is of white marble and was completed in 1339.

The next that requires mention among the masters of this age is Jacopo della Quercia, who formed the transition from the ancient ideal to the natural style. He was born at Quercia in 1368, and died in 1442. His chief works are in Florence, Bologna, Lucca, and Siena. In the last mentioned place is a large fountain ornamented by his chisel, on which, among other things, are the Virtues in the form of female statues. The bust of one of them is given in *fig.* 9. Among his contemporaries were Andrea Orgagna (d. 1389), Michele Algicani (d. 1400), Nanni d'Antonio di Banco (d. 1420), Luca della Robbia (d. 1442); the last mentioned distinguished himself by his little burnt and glazed statuettes, which were spread as his invention throughout nearly the whole of Europe. Lorenzo Ghiberti, born in Florence in the year 1378, is less celebrated as a sculptor in stone than as a caster of statues: his gates on the Baptistery of San Giovanni at Florence have procured him undying fame, Michael Angelo himself having declared that they were worthy to form the gates to Paradise. It was in the year 1401 that Ghiberti with the six best sculptors of Italy

entered upon a trial of skill respecting these gates; and thirty-four judges of art pronounced his, Brunelleschi's, and Donatello's designs the best, but the two last masters voluntarily yielded to Ghiberti. Besides these gates, Ghiberti cast several statues for the churches of Florence. His contemporary, the above mentioned Donatello, properly called Donato di Betto Bandi, was born in Florence in the year 1383. His merits as a sculptor are very considerable, and he was the cause of more attention being paid to the treasures of antiquity; in consequence of which the De' Medici and other princes began to collect into museums the ancient statues still extant, and to cause those which had suffered injury to be restored. His style is noble, his attitudes easy and graceful, and his draperies clear and natural; the heads and the action of his figures are characteristic. The number of his works is not inconsiderable: among them are a relief, *the Annunciation*, in Santa Croce, *St. Magdalen*, and *St. John the Baptist* (*pl.* 7, *fig.* 11) in the Baptistery. This last statue was carved in wood, and was afterwards cast in bronze, after Donatello's model, by the French sculptor Poncé. In the church of Or San Michele are the statues of *St. Mark*, *St. Peter*, and *St. George*, by Donatello, the last (*fig.* 12) being regarded as one of the best works of this master. He also executed many other works, among them the fine equestrian statue of General Gatta-Melata. He died in 1466. The transition from the 15th to the 16th century is formed by Andrea Verrochio, who was born in Florence in the year 1432, and died in 1488. He was a pupil of Donatello and teacher of Leonardo da Vinci; for Verrochio was a brass-founder, goldsmith, architect, painter, engraver, form-cutter, surveyor, carver, and musical composer, and in all these branches he excelled. When Verrochio was painting a *Baptism of Christ*, Leonardo da Vinci, then only thirteen years old, introduced into the picture an angel, whose beauty so astounded the master that he never after touched a pencil. Verrochio also introduced the process of taking plaster-casts from life, which had been invented by Lysistratus, a pupil of Phidias. His works are clever; his men's heads are full of expression (*fig.* 10 represents the bust of a bronze statue, an apostle in the church of Or San Michele in Florence); and his female heads, especially in the treatment of the hair, are so beautiful, that Leonardo da Vinci often copied them.

But of all the masters of that period Michael Angelo accomplished the most for the perfection of art, which he brought nearest to the antique, although his great powers sometimes led him into exaggeration. Michael Angelo Buonarotti was born, 1474, at Sattignano in the territory of Florence. He was a pupil of Domenico Ghirlandajo in painting and of Bertoldo in sculpture, after which he studied anatomy for twelve years in the convent of San Spirito. Of his merits as a painter we shall have occasion to speak hereafter: his architectural achievements were discussed in another part of this work; but it is as a sculptor that he manifested most conspicuously the deep seriousness of his disposition, the clearness and directness of his conceptions, and the sublimity with which he embodied them in his works. His forms are simple and grand, and are elevated above those of common life; his characters are no portraits of

individualities, and yet they display the profoundest knowledge of the human body and of the human soul. The attitudes depicted by him seem often rather violent; still they are never untrue to nature, but are in accordance with powerful emotion. Of his plastic works we will mention only the *David* in front of the old palace in Florence; a *Pietà*, a marble group in the church of St. Peter at Rome; and an *intoxicated Bacchus accompanied by a Satyr* (*pl.* 7, *fig.* 18), a marble group 10 palms high, and one of his first performances. It was intended for Giacomo Galli of Florence, but was placed by Cardinal Ferdinand de' Medici in the Florence gallery, where it still remains. Michael Angelo also designed the monument of Pope Julius II., which was erected in the basilica of San Pietro in Vincoli, but spoilt in the execution. Its chief ornament is the statue of Moses (*fig.* 19), which was to have stood with several other statues (of prophets and virtues) on the cornice. This colossal figure is now placed at the foot of the monument, and is certainly one of the master's finest works. About the upper part of the tomb stand a sort of persians, representing fettered slaves, one of which we have copied (*pl.* 8, *fig.* 2). Another monument executed by Michael Angelo was that of the Medici in the church of San Lorenzo of Florence, which is famed for its statues of the Medicean family, and for those of the seasons and of the different periods of the day. Of the latter we have given the *Morning* and *Evening* (*pl.* 7, *fig.* 20), which will justify our assertion that among modern sculptors there is scarcely one that can be compared with Michael Angelo. M. Angelo died at Rome in 1564.

A short time after Michael Angelo, Benvenuto Cellini assumed a high rank among sculptors and casters of statuary. He was born in Florence in 1500; and having at an early age manifested an inclination for the plastic art, he was apprenticed to a goldsmith named Andrea Sandro, and when scarcely fifteen years of age he surpassed the best of his companions. His works soon attracted attention; and a lily composed of diamonds set in gold for Porzia Chigi introduced him to the notice of several dignitaries of the church, for whom he then wrought a good deal. When Rome was beleaguered in 1527, Cellini served as bombardier in the castle of St. Angelo, where he shot down the Duke of Bourbon who had captured the city, and wounded the Prince of Orange. He was appointed master of the mint to the pope; but manifold persecutions caused him at last to enter the service of Duke Alexander in Florence, for whom he engraved many medals and dies. He was once more called to Rome; but being again attacked, after executing several splendid vases, he went in 1537 to the court of Francis I. of France. He returned to Rome, however, in 1540, where he was thrown into prison under a false accusation; but he was liberated by Cardinal Ferrara, for whom he executed many important works. Being again summoned to France, he there set up a complete workshop, having attracted to his employ many German workmen, whose industry and skill he highly praised. To this period belong his finest works, of which many still exist, *e. g.* in the Ambrase collection in Vienna, in Dresden, and in other places. Here too he executed several works in

sculpture, *e. g.* the enormous model of the statue of Mars, whose head served as a sleeping chamber, a bronze relief known by the name of the *Nymph of Fontainbleau*, and some others, among them the *Knight's Shield*, now in England (in St. George's Hall, Windsor Castle). Being permitted to revisit Florence, he entered into the service of Duke Cosmo, where he executed the famous but rather jejune statue of *Perseus* (*pl.* 7, *fig.* 16) for the market-place, which now stands in the Loggia Lanzi. In casting this statue more than 9000 pounds of metal were employed. The artist, however, received but a small part of his honorarium; for the duke, instead of the 16,000 gold scudi at which the work was valued, caused him to be paid only 3500, and that in sums of from 25 to 100 scudi. Cellini's last work was a *Saviour on the Cross* of the size of life admirably sculptured in marble, and which is now in the Escurial, Cosmo having presented it to King Philip II. of Spain. Cellini died in 1572.

Giovanni da Bologna (Giambologna), born in Douay, 1524, was a pupil of Michael Angelo, and distinguished himself as a sculptor and architect. When he once showed M. Angelo a prettily executed model in clay, the master chid him harshly, and told him he should first learn to design before he began to execute. This severity irritated the young man so greatly, that he applied himself to study day and night, with the resolve that his works should yet surpass those of his master; and in fact they were worthy to be placed beside the productions of the greatest artists. He lived till the year 1608. One of his finest works is the *Rape of the Sabines*, of which a copy was made in bronze for the king of France, while the marble original stands in the Loggia de Lanzi. His *Mercury* as messenger of the gods (*pl.* 7, *fig.* 17), an admirable marble statue, remains in Florence; and in Bologna the fine statue of *Neptune* in the principal market is from his hand, as are likewise the bronze gate of the Cathedral at Pisa, and the equestrian statue of Cosmo I. in Florence. Giovanni was emulated by his pupil Camillo Mariani of Vicenza, by whom there are several excellent works in the Vatican, in St. John's in the Lateran, and other principal churches of Rome. The same may be said of the works of Francesco Mocchi of Montevarchio, who owed his artistic education to Mariani. Mocchi was born in 1580, and studied very diligently; among his best works are the statue of St. Veronica, 22 feet high, for St. Peter's at Rome, and the two fine statues of the apostles Peter and Paul before the Porta del Popolo in Rome. There are other productions of his in the church of San Andrea della Valle and Santa Maria Maggiore in Rome; in which last mentioned place is the marble statue of the *Angel of the Annunciation*, copied in *fig.* 15, which proves that the works of Mocchi are distinguished for freedom of action, well managed drapery, correct drawing, and characteristic expression in the heads.

After it had thus taken three centuries to elevate art from the deep degradation to which true Vandalism and a long period of warfare had brought it, a single individual succeeded in again bringing it down to a low ebb. This man was Lorenzo Bernini, born in Naples in 1598, a pupil of his father Pietro Bernini. The boy, who was gifted with a great deal of

talent, is said to have sculptured a head in marble when only ten years old, and he certainly had a brilliant reputation both as sculptor and architect. His genius, which spurned all bounds, gave itself up to the quaintest conceits, utterly disregarding all the laws of true art and beauty, and every rule of good taste in sculpture. Hence he exerted a most deplorable influence on the entire plastic art of the 17th century, the effects of which reached far into the 18th century. His works are not creations of inspiration, but of a heated jejune fancy; accordingly they all betray more or less of affectation, and there prevails in all his works, in consequence of his preference for the pictorial principle, a mode of treatment that violates all the laws of the plastic art. So little did he care for truth to nature, that he even set himself to work to improve nature according to his perverted ideas, and so presented a phantom in place of the truth. As a specimen of his mode of composition we have copied his marble group of *Apollo and Daphne* (*pl.* 7, *fig.* 14), which is equally destitute of natural truth and of artistic inspiration. To the better class of his works, which unfortunately are too numerous in Rome, belong the immense figures of Constantine in the Vatican, and of Longinus in St. Peter's, as also the more delicate ones of St. Theresa in Santa Maria della Vittoria, and of St. Bibiena in the church dedicated to that saint. The tabernacle 90 feet in height over the high altar of St. Peter's church is a model of tastelessness; but what causes the greatest regret in connexion with this wretched production is the fact that to furnish the materials for casting it, the beautiful portico of the Pantheon was robbed of its pannelled ceiling and beams of bronze. Of Bernini's career as an architect in Rome and in Paris, where he was received with almost superstitious reverence, but where, nevertheless, his plans were not put into execution, we have already spoken under the head of Architecture.

5. Modern Times.

At the close of the preceding period we found that art in Italy had again begun seriously to decline; since the supremacy acquired by Bernini and his adherents, in consequence of the great favor shown them by the Pope, had sufficed to obliterate the impressions produced by the noble exertions of the true artists of the previous century, and to introduce into the plastic art a tasteless, unnatural, affected style, which robbed it of all its sublimity and its charms. It will now be our office to show how the various nations of modern times again discarded that periwig-style, and how the truly beautiful combined with the simplicity and sublimity of the antique have again attained the ascendency, so that now in more countries than one there are executed works of plastic art that deserve an honorable place beside the finest productions of classical antiquity.

A. Italy.

So powerful was the pernicious influence of Lorenzo Bernini in his day, that it had the effect of turning aside from their path even such masters as

Algardi. A few years younger than Bernini, who was born in 1598, Alex. Algardi first saw the light in 1602. In early youth he labored to perfect himself in drawing under Ludovico Caracci, and also in modelling; and notwithstanding many adverse circumstances, he at last succeeded in causing himself to be regarded as the best sculptor after Michael Angelo. His *Magdalen*, *St. John*, and *St. Paul* were universally admired; and the bronze statue erected by the senate to Pope Innocent, with which Algardi gained the victory over Francesco Mocchi, procured for him the cross of the order of Christ. Nevertheless his last great work, the famous bas-relief over the altar of St. Leo in the Capella della Colonna of St. Peter's, which represents Attila encountering Pope Leo I. on the banks of the Po, and frightened back by the apparition of St. Peter and St. Paul, degenerated completely into the pictorial style of Bernini. Algardi and Bernini found imitators in the sculptors Roggi, Ferrata, and Brunelli; and Rusconi and Zamba perhaps surpassed them. It was not till the middle of the last century that the investigations and the ardent zeal for the simplicity and true beauty of the antique of such men as Winckelmann and Mengs, supported by Cardinal Albani, rekindled a love for the antique and a taste for genuine art. Cavaceppi also, although as a sculptor he belonged to the school of Bernini, collected, restored, and described the remains of antiquity with spirit and knowledge of the subject, and his copies of them are truly estimable. The first, however, who introduced into Italy a new era of art, in which the spirit of the antique awoke to new life, were Trippel and Canova. Alexander Trippel of Schaffhausen was originally a cabinet-maker, but studied sculpture under Wiedevelt in Copenhagen; in which art he soon attained to such perfection, that he was able to go to the Academy at Dresden and afterwards to Rome, where he remained and executed several very important works.

Antonio Canova was born, 1757, in Passagno in the Venetian territory, and first applied himself along with Rafael Morghen, under Volpato's direction, to the art of engraving on copper. But this he forsook as there became developed in him a marked talent for sculpture; this last branch of art he studied in Bassano, and then went to the Academy at Venice, where in his 16th year he executed a statue of Eurydice. In the year 1780 he went to Rome, where he began and finished his *Theseus slaying the Minotaur* (this group is now in Vienna), and very soon gained so considerable a reputation that in 1787 he was intrusted with the execution of the sepulchral monument of Clement XIV. About this time he produced his *Perseus with the Medusa's head*, which was purchased by the pope and set up in the Vatican in place of the Apollo of Belvedere which had been carried off by the French. After Canova had made a tour through Austria and Prussia, he executed in Paris in 1802 the model for the colossal heroic statue of Napoleon. Pius VIII. conferred high honors upon him, and sent him again to Paris in 1815, to demand the restoration of the plundered treasures of art. Canova died in 1822, and there was erected to him in the Chiesa dei Frari the monument which he had designed for Titian. He had also essayed his genius in the line of painting, and placed a high

value on his works of that class. These were a *Sleeping Venus*, *a Sleeping Adonis*, *a Descent from the Cross*, &c. His masterpieces are the *Cupid and Psyche* (*pl.* 9, *fig.* 2) *and Hebe* (*fig.* 1), both in St. Petersburgh; two *Athletæ*, and *Perseus with Medusa's head*, in the Vatican; *Hercules dashing Hylas against a Rock*, a splendid group, in the possession of the banker Torlonia in Rome; *Napoleon with the sceptre and imperial globe* and *a Genius with a crown of palm branch*, at Apsley-house, London; *Venus Victrix*, also in a private gallery in England; *Venus coming from the bath*, in the Glyptothek at Munich; *the three Graces* (*fig.* 3) and the *penitent Magdalene* (*pl.* 8, *fig.* 3), in the Leuchtenberg Gallery at Munich; *three dancing girls* (one of which is given *fig.* 4); *the tomb of Alfieri*, in the church at Santa Croce at Florence, &c. One of his finest works is the monument which Duke Albert of Austria raised to his wife Maria Christina, Duchess of Saxe-Teschen in the church of the Augustines at Vienna (*pl.* 11, *fig.* 11). It is entirely of white marble, and represents the sepulchral pyramid of the deceased, in which the mourning people, represented by the four ages of life, deposit the ashes of the beloved princess. A lion and a genius recline together on the opposite side of the gate of the pyramid, bearing the arms of Austria and of Saxe-Teschen. Another genius, accompanied by a winged palm-bearer, designates the pyramid more precisely by placing the bust of the princess over the entrance. The beautiful and expressive epitaph is, *Uxori optimæ Albertus.* The whole monument is executed in the most elegant manner, and breathes the profoundest sadness: the group to the right is transcendently beautiful. Canova has the undisputed merit of having greatly elevated the plastic art, and of having labored with all the zeal and earnestness of conviction to give it a fixed aim, that of grace and beauty, after the example of the ancients. The tendency of his own individual taste led Canova wherever he could, to avoid sharp forms; so that he sometimes borders on the feeble and affected, and his smooth figures seem almost destitute of bones. He usually polished his statues or coated them with a yellowish varnish. He was accustomed to model his works, leaving the shaping of the marble to skilful workmen, after which he applied the finishing touches himself.

B. France.

In France also, a country which in so many respects has derived the materials of its cultivation from abroad and afterwards worked them up in its own manner, the baneful influence to which the plastic art had been subjected in Italy made itself sensibly felt, especially as the French wantonly introduced into the domain of art the follies of their code of fashions. From the time of Jean Gougeon, who in the year 1550 had revived the taste for sculpture in France, and whose Caryatides in the Louvre, in the hall of the Swiss, are still celebrated, art had made sure though gradual progress; yet even Germain Pilon (d. 1605), who first succeeded in representing the difference of texture in marble, shows mannerism and occasionally inelegance in his works. A comparison of his masterpiece the *Three Graces with the urn* inclosing the hearts of Henry II. and Catharine de' Medici (*pl.* 8,

fig. 1), formerly in the church of the Celestines but now in the Museum, with the *Graces* of Canova (*pl.* 9, *fig.* 3) or of Thorwaldsen (*fig.* 5), will convince any one of the truth of our assertion. The same defects attach to the works of Sarrassin, the brothers Anguier, Theodan, Puget, Pierre le Gros, &c.; and Pigalle is the first who shows a purer taste in art, although he too leaves much to be desired. Pigalle was born in Paris in 1721, and was a pupil of the sculptors and brass-casters Lemoine and Lemayne, and in 1752 was professor in the Royal Academy of Paris. His talents first made themselves conspicuous after his return from Rome; and his *Mercury and Venus*, which afterwards became the property of the king of Prussia, rendered him famous. There are a considerable number of statues by him, among them that of *Louis XV.*, and many fine reliefs. His best production was the monument to Marshal Saxe, which is still to be seen in the church of St. Thomas at Strasburg. We have copied it in *pl.* 10, *fig.* 11. This mausoleum is regarded as the most beautiful of that period, and is in fact very skilfully composed; although the mailed form of Maurice of Saxony does not harmonize with the allegorical figures, neither do these latter, especially the ancient Hercules and the modern skeleton, with each other.

The commotion produced in France during the age of the revolution and those succeeding it was naturally not without its influence on the arts. But after the first blast had passed over and the waves of the stormy sea had subsided into something like quiet, art again reared its pinions for a vigorous flight; and accordingly towards the close of the last and during the present century many good works have been produced, indeed everywhere we behold the influence of a refined taste and of an earnest study of art. It is true that in the choice of subjects many allusions may be perceived to the events of the times, as *e.g.* in Chaudet's *Cincinnatus* (*pl.* 8, *fig.* 7), in Fogatier's *Spartacus* (*fig.* 9), and in the reliefs on the numerous triumphal arches and monuments; yet everywhere the study of the antique is conspicuous, and as the example of the ancients was imitated in the republic, so it was in the plastic art, even down to the cutting of dies. As a specimen of the style of the period in relief we present a copy of a work of Chinard's, taken from the triumphal arch in Bordeaux (*pl.* 11, *fig.* 13): it represents *Bellona* receiving a wreath from the *Genius of Fame*, and adorning with it the brave and ardent warrior. To this period belongs also the statue by Ph. Gross of General Kleber (*fig.* 10), who was assassinated in Egypt, which decorates his monument in his native city Strasburg, and is a masterpiece of composition. Yet there was no lack at the same time of works of a different class; and while for fifty years France was almost without interruption in a state of convulsive excitement, art quietly held on its way, and sought the subjects for the exercise of its skill in every department both of prosaic and poetic life. We cite as examples the *Dancing Neapolitan*, by Duret (*pl.* 8, *fig.* 8); the group of *Ino and the Boy Bacchus*, by Dumont (*pl.* 10, *fig.* 7); and the group of *Leda and the Swan* (*fig.* 8), by Seurre jeune; in which the study and to some extent the imitation of the antique cannot fail to be observed.

An independent path was struck out by Jean David of Angers; he was to French what Canova was to Italian, and Tieck, Schadow, Rauch, and Schwanthaler to German art, and he conducted it by the narrow way which leads between a slavish imitation of the antique and a mere copying of nature to the truly beautiful and sublime. Born in the year 1792, he devoted himself from his earliest youth to art, but lacked the means for pursuing his studies; his namesake, the painter David, assisted him and gave him instruction until a stipend was allowed him. The first work with which he appeared before the public was a relief, the *Death of Epaminondas* (*pl.* 11, *fig.* 12), which is in truth one of the most beautiful and expressive compositions of the period, and in 1811 received the first prize for a bas-relief, with which a studying-pension was connected. David now went to Rome, where he studied the antique, and enjoyed the benefit of Canova's instruction; after which he repaired in 1816 to England, to study the marble monuments carried off from Greece by Lord Elgin. The proposition, honorable to him in itself, to execute a monument with reliefs in honor of the victory of the English and German army, he as a good patriot rejected, and returned to Paris, where in 1822 he executed the statue of *King René* for the city of Aix, and a *St. Cecilia* for a Parisian church. In the year 1827 he produced the statue of *the great Condé* (*pl.* 10, *fig.* 4), which represents the hero at the moment of hurling his commander's staff into the enemy's redoubt, to rush forward at the head of his troops and recover it. This statue was designed as a pendant to that of *Admiral Duquesne* by Roguier (*fig.* 1), and, with the statues of *Bayard* by Moutoni (*fig.* 2), of *Duguesclin* by Bridan (*fig.* 3), and of eight other heroes and statesmen of France, to adorn the bridge of Louis XV. built by Perronnet, now the Pont de la Concorde. These statues, however, were removed, and stand now in the Museum of Versailles, while the bridge still waits for a substitute. It would here lead us too far to enumerate merely the principal works of this prolific and industrious artist, which are scattered through all parts of Europe, especially as David has manifested a great fondness for portraits. It is in this line and that of bas-relief that he has furnished the finest specimens of his talent; though it is not to be denied that he has occasionally manifested in his most celebrated works of the kind an excessive striving after effect. This is shown, for instance, very plainly in his two busts of Goethe, one of which is at Weimar and the other in Dresden, and in the bust of Tieck in Dresden. Especial notice is due to his bust of Alexander Von Humboldt, which is perfect as a likeness, and is justly famed for the sublimity which the artist has given to the brow of the illustrious naturalist. We must mention in conclusion a few of David's sculptures which belong to the most recent times. Among these is *Gutenberg's Monument in Strasburg*, which was executed in bronze after a model by David (*pl.* 11, *fig.* 3). In the physiognomy of this colossal figure we notice rather a straining after great expression than the manifestation of a profound intellect. The deep folds and furrows of the countenance, beard, &c., give an appearance of hardness. There is also something constrained in the figure, and the drapery exhibits nothing of the grand style.

But notwithstanding the singularity of David's *Gutenberg* in point of composition and drawing, and its disregard of the laws of artistic conception as respects the figure, in the poetry of the thought it surpasses even that of Thorwaldsen in Maintz (*fig.* 4): the latter represents the inventor of printing with movable types in his hand; whereas David has placed a proof-sheet in his hand, on which are printed the words, *Et la lumière fut!* (And there was light!) Besides several monuments, among which are those of Cardinal Cheveru and the physician Larrey, David has produced a number of genre sculptures which have received universal applause and of which we shall mention here only the *Boy relishing Grapes.* David in his works had departed from the cold imitation of the antique, and knew how to express his ideas in a free and suitable manner; although sometimes, as we have mentioned above, he fell in consequence into a forced attempt at effect. As an opponent of the baldness and severity of the antique, he practises a style of sculpture exceedingly powerful and effective and hence perfectly adapted to the colossal; at the same time it is very different from the prevailing mode of treating clay and marble especially in Germany, and gives him liberty to exercise that warmth of inspiration and bold sweep of the hand with which he embodies his ideas. Yet notwithstanding his aversion to the antique, David pays his tribute to its excellence, especially in the nude figure; and here he inclines less to the Hellenic than to the luxuriant Roman.

In speaking of French sculpture, we must make mention of a female artist, whose early death was a severe loss to art. It was the Duchess Marie of Orleans, a daughter of Louis Philippe, late king of the French. She was born at Palermo in 1813, and in 1837 was married to Duke Alexander of Wirtemberg, whom she accompanied to Germany, but a fire having occurred in the castle of Gotha, at which she took cold, she went to Pisa for the recovery of her health and died there in 1839. This princess had a great talent for sculpture, and we have by her the well known most graceful and spirited statue, of the size of life, of the *Maid of Orleans* (*pl.* 8, *fig.* 10), which stands in Versailles; and in Paris the equestrian statue of the same heroine represented in the act of striking down an Englishman with her battle-axe. Her last work was a very beautiful angel of white marble, which now stands in the chapel of Sablonville on the sarcophagus of her brother, the Duke of Orleans, who met his death by an accident in 1843. The productions of the young princess are equally remarkable for the spirit of their conception and the beauty of their execution.

C. Germany.

The plastic art of Germany in the middle ages struck out a path of its own, and consequently exhibits a high degree of originality; and although we find in it no traces of a study of the antique, there resides in most of its productions an expression of much grace and loveliness, combined with power and dignity, and a very earnest study of nature. The works of an Albert Durer, Veit Stoss, Adam Kraft, George Surlin, Peter Vischer, and nume-

rous others, give proof of this; and the later masters, as Balthasar Permoser, Schlüter, &c., did all in their power to preserve the art handed down to them in its purity, until at length the turgid style and perverted taste of the periwig period, which had originated in Italy and infected France, extended also to Germany and furnished that country with their rococo images. Fortunately this period did not last very long in Germany; for German good sense expelled the foreign intruder betimes. In Italy itself this false taste was combated and a nobler art revived by Germans: the names of Trippel, Winckelmann, and Mengs are become immortal, and sufficiently attest the German sense of the beautiful. But recent times have produced an array of artists of world-wide celebrity; and if Italy has her Canova, France her David, and Denmark her Thorwaldsen, we find contemporaneously or in quick succession in Germany the names of Zauner, Schlüter, Schadow, Dannecker, Tieck, Rauch, and Schwanthaler, all of them heroes in the art of sculpture. We will here give some account of each of the five masters of the most recent times.

Joh. Heinr. Dannecker, the son of a groom, was born in Stuttgard in the year 1758, and, like Schiller, was a student at the Charles-school, but devoted himself to sculpture. As early as 1776, at the competitory exhibition, he gained the first prize for his *Milo attacked by Lions*, and in 1780 he was appointed by Duke Charles sculptor to the court, with permission to pursue his studies in Paris and Rome. Here he soon distinguished himself; and after he had been there five years, his statues of *Ceres* and *Bacchus* gained him admission into the academies of Bologna and Milan. In the year 1790 he returned to Stuttgard, where he was greatly honored, and had a title of nobility conferred upon him. Besides his *Ariadne*, in the possession of the banker Bethmann of Frankfort (which cost 20,000 guilders, or $8000), we will mention his *bust of Schiller;* his colossal *Christ*, in Russia; and his *Amor* and *Psyche*, both in England. Dannecker died in 1841.

Joh. Gottfr. Schadow was born in Berlin, in 1764, a few years after Dannecker. He was the son of a tailor, and was taken to instruct by a pensioned sculptor of the court. He married early and went to Italy, where he wrought so industriously and with such success as to obtain at a competition the highest prize. He was made rector of the Academy of the Plastic Arts in Berlin, an office which he held from 1788 till his death, which occurred recently. Schadow was the father of sculpture in northern Germany, as Dannecker was in the south. The number of his works is very considerable, and they are distinguished by great truth to nature and vigorous conception, while those of Dannecker breathe more the spirit of the antique. Though Schadow also was no stranger to this; as many of his works, and especially the beautiful frieze on the Mint in Berlin, &c., demonstrate. Schadow executed the monument of Count Von der Mark in the church of St. Sophia in Berlin, and that of Frederick the Great in Stettin, for which even the French showed such great respect that at the last siege they took precautions to prevent any injury to it from their balls. This beautiful statue is of white marble. The statue of Duke

Leopold of Dessau, known by the name of "the old Dessauer," and the model of the beautiful quadriga over the Brandenburg Gate in Berlin are works of Schadow's. He too was raised to the rank of nobility. Schadow had two sons, one of whom, Rudolf, born in 1786, also a sculptor of reputation, died at Rome in 1822; his *Girl spinning* and *Girl binding her sandal* are famous. His last work, *Penthesilea*, was finished by his friend Wolf. His brother, Wilhelm von Schadow, is painter and director of the Academy of Arts at Dusseldorf. He was born in 1789.

Christian Frederick Tieck, a brother of the famous poet Ludwig Tieck, was a pupil of the elder or so-called "old Schadow." He was born in Berlin in 1776, and exhibited at an early age so great a talent for sculpture and drawing, that, after being for a while under the instruction of Bettenkober, he was received by Schadow into his atelier, and afterwards perfected himself in Dresden, Paris, and Rome. His forte, like that of David in Paris, to whom Tieck is greatly indebted, lies in portraits; and a good portion of the busts of celebrated Germans placed in the Valhalla at Regensburg are the productions of Tieck's chisel. But he has also produced some admirable larger works. We will instance only the statues wrought in copper after his model in the cathedral at Berlin; and his beautiful ornamental works on the theatre newly erected in Berlin by Schinkel.

But of greater importance for the advancement of the art of sculpture in Germany are the works of Christian Rauch. He was born at Arolsen in Westphalia, in 1777, and made his first studies under Ruhl in Cassel, but was compelled by necessity to change for a while his intended course of life and become page to queen Louisa of Prussia. He here employed his leisure hours in modelling and sculpture; and this coming accidentally to the knowledge of the queen, she furnished him the means of completing his studies and going to Rome, where he produced many busts and reliefs, until the king of Prussia recalled him in 1811 and charged him with the execution of a sarcophagus for the queen, who had died in the meanwhile. Rauch performed the task; and in the exquisitely beautiful sarcophagus, which forms a couch whereupon the body of the queen reposes, we recognise the pious gratitude with which the artist labored on this tribute to the memory of his benefactress. The monument stands in the small sepulchral chapel in the royal tomb in the palace garden of Charlottenburg near Berlin, and which now contains also the sarcophagus of the king himself likewise executed by Rauch. Rauch has produced besides these a great number of admirable works. We will mention only the statues of generals *Scharnhorst* and *Bülow of Dennewitz* near the main guard-house in Berlin, and opposite the statue of *Prince Blücher of Wahlstadt* near the opera house, which were modelled by Rauch, cast by Lequine, and chiselled by Vuarin; and on the pedestals of which, in the historical groups, we recognise among the standard-bearers the portraits of Tieck, Rauch, Schadow, and Schinkel. Rauch modelled another bronze statue of *Blücher* for the city of Breslau, and also the beautiful monument to the deceased king *Maximilian I.* of Bavaria for Munich. This monument has likewise very fine reliefs and works executed

in full on the pedestal; we copy here the statues of *Felicitas publica* (the Public Weal) (*pl.* 10, *fig.* 10), and of *Bavaria* (*fig.* 9), to show how Rauch combined a true conception of nature with a very refined study of the antique in the design and execution of his works of art. Rauch has been very happy in modifying as far as possible the unpicturesque forms of the military dress, so as not to offend the æsthetic feeling which demands drapery of a free, unconstrained, picturesque character. The number of his portrait-statues and busts is very considerable. Thus we have by Rauch a statuette of *Goethe*, and the statues of *Luther* in Wittenberg, of *Albert Dürer* in Nürnberg, of *Francke* in Halle, of the two princes *Mieczislaus* and *Boleslaus* in Posen, and of *Frederick William I.* in Gumbinnen, which were all cast after his models. The four large *Victories* in the Valhalla at Ratisbon are also by Rauch, as well as countless other works of art, one of the most interesting of which is *Laurentia of Tangermünde on the Stag*. Recently Rauch has finished and erected a colossal equestrian statue of *Frederick the Great*, which is placed at the entrance of the Linden in Berlin, and is one of the grandest monuments of our time. It is true that during the last centuries the Germans have gone to excess in erecting monuments; still it is not to be denied that the style of the monuments bestowed by the Germans on their poets and statesmen, especially their favorites, is better calculated to satisfy a true feeling for art than those which have been erected by Britain to her poet Burns in Calton Hall, Edinburgh (*pl.* 10, *fig.* 12), and to her philosopher Dugald Stewart on the Calton Hill, Edinburgh (*pl.* 11, *fig.* 14), which are feeble imitations of the ancient choragic monuments.

We have still to speak of one other German sculptor, Ludwig Michael Schwanthaler, who is among the most prolific of artists, if we compare the number of his works with that of his years. This recently deceased master was born in Munich in 1802; and after receiving instruction in the elements of his art from his father, who was likewise a sculptor, he entered in 1818 the Academy of Munich for the purpose of pursuing his studies in sculpture, but was already too independent to change the course he had marked out for himself. On that account he left Munich for Rome, and there in the year 1826 enjoyed the instruction of Thorwaldsen; after which he returned to Munich and set up an atelier of his own. Schwanthaler executed for the Glyptothek several reliefs on subjects taken from the Iliad; next for the palace of Duke Max in Munich a frieze of more than 150 feet in length, representing a wonde ful *Bacchanal*, and then two large friezes in the new palace in Munich, one of which represents the *Myth of Venus*, and the other the *Olympic Games*. Among many designs produced by Schwanthaler we will instance only those of the wall-paintings for the six halls in the new palace on subjects from the Odyssey. For the hall of Barbarossa he executed a frieze from the crusades, and for the presence chamber the models for twelve bronze statues of the ancestors of the royal house of Bavaria. Of these statues we have copied two: *Otto the illustrious* (*pl.* 11, *fig.* 1), and the emperor *Ludwig the Bavarian* (*fig.* 2), to show how admirably Schwanthaler managed the costume of the middle ages, even

when it seemed ill adapted for the purposes of art. It will also be perceived from these figures that Schwanthaler's drawing is beautiful and correct, and his movements animated and true to nature; each one of his works is a new proof of the correctness of these assertions. Many honorary statues have proceeded from the hands of Schwanthaler; of which we will mention only that of *Mozart* for Salzburg, which represents the composer in an attitude of inspiration (*pl.* 10, *fig.* 5), while the reliefs on the pedestal (*figs.* 5[a] and 5[b]) portray the sisterly union of the muse of painting and sculpture with that of music (the Opera), and a singing scene (Song). Schwanthaler likewise modelled the statues of *Jean Paul* in Baireuth, of *Goethe* in Frankfort, of *Margrave Frederick* in Erlangen (*fig.* 6), of *Kreitmayer* in Munich, and of *Ludwig of Hesse* and *Charles Frederick of Baden*, the two last for Carlsruhe. Schwanthaler executed several works in sandstone, limestone, and marble, some for the Ludwigskirche, some for the Pinakothek, and some for private persons; but he gained especial celebrity by the reliefs on the pediments of the Walhalla at Regensburg, one of which, the front one, he executed after Rauch, but the other, the *Battle of Arminius*, after his own design. The relief on the new Exhibition-building at Munich, representing the arts under the protection of Bavaria, is also by Schwanthaler. His grandest work, however, was the model for the colossal bronze statue of *Bavaria*, which he did not live to see finished. It was erected before the gates of Munich in the summer of 1850, and dedicated by ex-King Ludwig I., in the month of October. Its colossal dimensions, which are admirably disguised by the most exquisite truth in the proportions, were demonstrated at the solemnities attending the erection of the head, from which at a certain elevation *thirty-two artists* emerged descending one by one by a ladder placed against the lower edge of the throat!

D. England and Denmark.

While art was making vigorous progress in France and Germany, much was accomplished for it in England also; yet the number of celebrated English sculptors is not very considerable. John Flaxman kept true to the strict study of the antique, with which in most of his works, and especially in his designs to illustrate the Greek poets, he associated a great deal of winning grace and delicacy. Chantrey also, whom the English call their Canova, has judiciously combined the antique with the natural in his statues of Watt, Canning, Malcolm, and George IV., in his group of sleeping children, &c.

We now come to Bertel (Albert) Thorwaldsen, who, a descendant of kings (his ancestor was King Harald Hildebrand of Denmark, though his father was a poor ship-carver), rose to be king of sculptors. Even his birth seemed to call him to a special destiny: for he was born at sea, in 1770, as his parents were on the voyage from Iceland to Copenhagen. From his earliest childhood Thorwaldsen busied himself with the art of sculpture; and when in his 17th year he wrought in the Academy under Abildgaard, he almost invariably obtained the prize. In the year 1796 Thorwaldsen went to Italy, where he was kept after completing his studies by Hope the

English banker, who ordered the execution in marble of his model of the statue of *Jason* (*pl.* 8, *fig.* 5), which in despair of encouragement he was about to break in pieces. The great beauty of the finished statue founded his reputation as a master, which several works in rapid succession confirmed, and it soon became a point of honor among the wealthy to possess a work of Thorwaldsen's; so that Protestant as he was, he was intrusted with the execution of the mausoleum to Pius VII. in the church of St. Peter. Thorwaldsen visited his paternal city only four times, and resided for many years in Rome. At last he came to Copenhagen in 1842, where he suddenly died in 1844; he left his native country his heir, which has collected his works and his treasures of art in the Thorwaldsen Museum. The number of his productions is very great, so that we cannot even name them all; but one of his chief works is the *Procession of Alexander*, which he designed in honor of Napoleon, for an apartment in the Quirinal at Rome, and which was executed in marble for the Villa Sommariva on the Lake of Como. We have copied (*pl.* 9, *figs.* 7–11) some fragments of this frieze, which is 110 feet long, and 3 feet 8 inches in height, and the plaster model of which was completed in the space of three months. By this work Thorwaldsen proved that even a modern master could penetrate completely into the spirit of the antique and vie with the classical plastics of the Hellenes themselves. On repeating the work in marble, Thorwaldsen added to it another group, representing Count Sommariva and himself. The frieze was afterwards put in marble again for the castle of Christiansburg in Copenhagen, and as it needed to be longer, the artist added to it several other groups. The subject of this relief is the entry of Alexander the Great into Babylon, which the Persian general Mazæus delivered up to him without striking a blow. Thorwaldsen could not of course represent the entire scene as described by Curtius Rufus in his Life of Alexander (Book V.); but he has arranged in beautiful order the most important particulars. The artist conducts us, first to the banks of the Euphrates, which is represented by fishermen and the river-god himself, whom Thorwarldsen erroneously called the Tigris. Before the walls of Babylon we behold a shepherd with his flock; and close by, an altar of incense guarded by two warriors. We have given the end of this group in *pl.* 9, *fig.* 7. The two seem displeased at the friendly reception of the conqueror; on the countenances of the shepherd and shepherdess we see portrayed the intense expectation of the coming events; while the boy in utter indifference is playing with a sheep. To the group here described are joined the priests and magi, before whom horses, a lion, and a tiger are led as presents to the invading general. Music heads the procession; before which advances Bagnophanes, the treasurer of Babylon, marshalling the array, and causing altars to be hastily erected at intervals. Girls strewing flowers precede the procession, at the head of which is the goddess of Peace with a horn of plenty and a palm-branch, and behind her appears the Persian general Mazæus with his children beseeching clemency. Opposite this group begins Alexander's procession, coming towards that of the Persians. At its head appears the conqueror himself (*fig.* 9), on a brazen quadriga,

which the winged goddess of Victory herself guides to meet the goddess of Peace. This group, in the first copy of Alexander's Procession, of which as is well known there are five in existence (one, properly only a plaster sketch, in the Quirinal; one in marble, for Count Sommariva; a new sketch, wrought entirely anew and of half size, in the Museum; a frieze executed in marble and of full size, after the last mentioned, for the castle of Christiansburg; and a copy of that in the Quirinal, for the Duke of Leuchtenberg), was quite differently and in general more quietly arranged, and only the copy in the castle of Christiansburg has it as it here appears. Behind this group begins the victorious procession of the army with Alexander's armor-bearer, followed by Bucephalus with his grooms leading him; next Alexander's generals, Hephæstion, Parmenio, and Amyntas; after whom comes an adjutant, and then the wonderful group of horsemen in *pl.* 9, *fig.* 10. This group likewise is not found in the Quirinal copy, but was composed for Christiansburg and adopted in the copy of Sommariva. After this follows a very beautiful one of four horsemen, and after these the group of horse and foot in *fig.* 11; these again are followed by an elephant, as a symbol of the spoils of war, loaded with conquered weapons, and the famous casket which Alexander withheld from the booty, to keep in it his copy of Homer which everywhere accompanied him; and after it a captive Persian chieftain. The whole procession is closed in all the copies by a group in which Thorwaldsen himself appears viewing the procession; but in Count Sommariva's copy Thorwaldsen appears in an animated attitude explaining the whole procession to Count Sommariva and his son.

Of Thorwaldsen's pieces on mythological subjects we will mention only his *Venus Victrix with the apple of Eris*, in the act of seizing her garments to put them on again (*fig.* 4), for Lord Lucan; *the Three Graces* (*fig.* 5), for the Duke of Augustenburg, a charming composition; and *the Apollo* (*pl.* 8, *fig.* 6), executed for the Countess Woronzow, the model of which, in place of the trunk of a tree, has the Delphic tripod. Of his mythological and historical bas-reliefs we will instance only in addition to those mentioned above, his beautiful relief of *Achilles and Briseis* from Homer's Iliad, V. 345 et seq., which is copied in *pl.* 9, *fig.* 6. This relief was Thorwaldsen's first production of the kind in Rome. It was executed while the Jason was being blocked out; and it laid the foundation of Thorwaldsen's fame as a master of composition, which he ever after retained. This relief has been twice transferred to marble, once for the Duke of Bedford in Woburn Abbey, and once (before that) for Herr von Ropp in Mitau, when the composition was somewhat altered. Here also should be mentioned the two celebrated reliefs of *Night* and *Morning*. Of subjects taken from the Christian religion we can allude only to the colossal *Christ and the twelve Apostles*, the *Angel of Baptism*, *Christ's procession to Golgotha* and several other bas-reliefs in the cathedral of Copenhagen, whose gable is ornamented with one of Thorwaldsen's most wonderful groups in detached figures, representing *St. John the Baptist preaching in the Desert.* In addition to the above works, Thorwaldsen designed and modelled a considerable

number of epitaphs and monuments, *e.g.* the monument of Pope Pius VII., already mentioned, of Copernicus in Warsaw, of Count Potocki in Cracow, of the Duke of Leuchtenberg in Munich, of the electoral Prince Maximilian of Bavaria in the same city, of Conradin of Suabia in Naples, of Schiller in Stuttgard, of Gutenberg in Maintz, &c. The statue of Schiller's monument is copied in *pl.* 11, *fig.* 7, and *figs.* 8 and 9 show two of the reliefs of the pedestal; of these *fig.* 8 is the front, representing an apotheosis of Schiller (the two Zodiacal signs are those of the months of Schiller's birth and death), and *fig.* 9 is the rear; the two sides contain hovering angels. *Fig.* 4 represents the statue of Gutenberg's monument, which as a statue is altogether superior to that of David (*fig.* 3). *Fig.* 6 is a relief from the base, representing the invention of movable types; and *fig.* 5 is another relief which represents the first execution of the art of printing and Gutenberg in the act of examining a proof-sheet. Characteristic attributes are given to the statue itself, which holds movable type in its right and the newly printed Bible in its left hand.

II. PAINTING.

As the sense of form, so too the sense of color is deeply implanted in the nature of man; and we meet in all times and in all countries with proofs that men have practised the art of painting in some mode or other, even though it be limited to staining or painting their own bodies or the objects which they have carved or constructed. The question has been asked, Which of the two arts is the older, painting or sculpture? It would lead us too far to enter here into a discussion of this question: still it appears to us that sculpture must almost of necessity have preceded that painting to which the term "art" can be applied; for to us it seems easier for the uncultivated man to mould soft clay into the shapes of objects, and even to execute images of them in hard stone, imperfectly to be sure, than to represent raised objects at different distances and hence perspectively, by drawing on a plane surface. A proof of the correctness of our supposition is furnished by the fact that we have plastic works of the Indians, Medes, Babylonians, and Persians, which are even brought to a certain degree of perfection; while of their paintings not a trace is to be found, if we except a few instances where colors are spread over walls and ceilings or over sculptures, whose antiquity, moreover, seems hardly established with sufficient certainty.

We must divide our brief survey of the history of painting, as we did that of sculpture, into two great periods, the painting of antiquity and that of the middle ages and modern times.

1. Antiquity.

The period of antiquity extends from the time when we meet with the

first traces of painting properly so called, *i. e.* the endeavor to represent corporeal objects with the colors belonging to them on a plane surface, among the Egyptians, down to the utter decline of this art at the time of the introduction of the Christian religion.

A. The Egyptians.

We have found among the Egyptians the evidences of a considerable degree of culture, as compared with other ancient nations, in their architecture and sculpture as well as in other arts of scientific and social life; and the same is the case with respect to painting, although this stood at a considerably lower degree of advancement than the plastic art.

The painting of the Egyptians commences with the coloring of statues and reliefs, and does not change its character through being transferred to a level surface, whether it be walls, or tombs, or hypogæa, or the outside or inside of mummy-chests, or the byssus wrappers of mummies, or rolls of papyrus. The colors, mixed with glue or wax, are applied to the stone, or in the case of mummy-chests to a thin layer of gypsum, without regard to light and shadow; and without mixing or shading. The same simple coloring materials are employed everywhere in the same manner, with some though a very slight regard to the natural local colors, although sometimes a symbolical signification appears to be aimed at. To men is usually given a peculiar flesh color; women have somewhat more of a yellowish tinge; quadrupeds are usually red, birds for the most part green and blue, and so too is water. But everywhere the same type occurs in the drawings to which we have alluded in speaking of the reliefs. The Egyptians remained in drawing pretty much as if they were dealing with round sculptures, a new proof that sculpture is older than painting; and even in the ripest age of their art they stand at the point where other nations usually begin: they never got beyond the straight, angular, scarcely waved strokes of the first outlines of their figures, and to these figures they gave very little action, so that one is almost exactly like the other. The position and play of the muscles, together with the manifold variations which they produce in the body according to its different inflexions, the Egyptians, if acquainted with them, were unable to imitate in drawing and painting, on account of their ignorance of chiaroscuro. Still it excites our astonishment to behold in these paintings, how defective soever they may be, in the royal tombs, on the ceilings of Denderah and Syene, and on the overturned Sphinx at Heliopolis, the same glowing colors and the same perfect freshness that they exhibited at the time of their execution thousands of years ago. Count Caylus ascribed this circumstance to a mordant added to the color; yet colors usually suffer by the addition of sharp mordants, and hence we are tempted to attribute it rather to an admixture of wax, by means of which the colors were made to penetrate deeper into the stone. It may also be possible, according to the opinion of some antiquarians, that the reliefs of the Egyptians were moulded, after the fashion of our clay models, out of a plastic, colored mass, which gradually acquired the hardness of stone; and such compositions we have at the present day, which become hard enough

to strike sparks with a steel. According to this view their reliefs and paintings were a sort of mosaic prepared in a moist state. Perhaps we have here the first trace of fresco painting, an opinion which seems in the highest degree probable.

But although these Egyptian paintings may rank very low as artistic productions, yet for the study of the history of the manners and customs of the Egyptians they are of inestimable value; for they afford us an insight into the domestic and social life of the people which scarcely leaves anything to be desired. This is especially true of the paintings which adorn the royal tombs and the Egyptian tombs in general, as these paintings usually relate to the former occupations of the deceased (see Architecture p. 10, or p. 10 of this volume). Thus we find in one tomb scenes from the life of a shepherd or of a husbandman, in another hunting scenes, in a third, fishing, &c. In one grave we find represented arms and implements of war, in another musical instruments, and a third shows us the religious and domestic usages and institutions of the Egyptians in their smallest details. The scene in *pl.* 12, *fig.* 1, will serve as an example. It represents the hallowing of the water of the Nile, a domestic ceremony which took place at each overflow of the river. The Nile water is celebrated for its palatable and salubrious qualities, and at the time of the overflow a stock of it was laid up in every household. Our view represents the interior of an Egyptian house. We see the whole family assembled in the principal apartment, with the master of the house at their head, and engaged in the act of blessing the water, of which we see a stock already stored up together with other provisions along the upper part of the walls; while other vessels of water are being brought in, as it appears, from out of doors, which have just been drawn. In the upper corner of the picture we see, in a sort of green-house or garden-house, a similar transaction going on. Another Egyptian picture is given in *fig.* 2, in which two parties are seen playing a game which bears a very close resemblance to our chess. In these two pictures will be found confirmed the assertion which we made respecting the drawing and the monotonous attitudes of the figures; although it cannot be denied but there are many points, as *e. g.* the distinction between the races of mankind, which evince a talent for accurate observation. Both of these paintings are from tombs. In the temples paintings are of rarer occurrence, and were in general confined to the coloring of reliefs; but where actual paintings exist, as in the halls of Carnak, they relate for the most part to historical events and to sacred rites.

B. The Etruscans.

We have already, in speaking of the sculptures of the Etruscans, had occasion to express our opinions respecting the origin and the progress of civilization of this people and concerning the remains of sculptures and castings which have come down from them to our times. Of their skill in painting and drawing we also possess valuable relics in the wall-paintings of the tombs, the pictures on vases, and the engravings on metallic mirrors. The subjects delineated were usually taken from domestic life or from their

religious myths. The drawing is rather meagre, the forms conventional without imitation of nature, and the drapery is indicated by fine lines rather stiffly and without being divided into masses. The features are usually destitute of expression except that they seem inclining to a smile. The coloring consists of colors laid on simply and separately without light and shade, and constantly reminds us of its Egyptian origin. In later times Grecian art exerted a great influence on the Etruscans, and the later Etruscan vases are in no respect to be distinguished from the Greek; in the ornaments especially, the Greek feeling for the beautiful is far more prominently active. The Etruscan paintings which we possess exhibit a progressive improvement in the style from the formally severe to the light sketchy manner. The localities where the greatest quantities of vases have been found are Arezzo, Camino, Chiusi, Corneto (the ancient Tarquinium, where are also the hypogæa of which we have spoken under Architecture, p. 36), Viterbo, Volterra, and Vulci; these vases exhibit the utmost variety in their forms and sizes. In *pl.* 12, *figs.* 3–7, and *pl.* 13, *figs.* 1–4, we have copied a number of patterns.

Pl. 12, *fig.* 3, represents a vase the painting of which is displayed in *fig.* 7. The sitting figure, probably a young bride, holds in her right hand a mirror, and in her left apparently an apple, both attributes of Venus, the goddess of love. Before her stands a winged genius, probably Amor, who is talking to her. On one side is a female attendant with an apple and a wreath, and on the other a maiden bringing a bowl containing fruit. The vase is 1 foot 2¼ inches high. *Pl.* 12, *fig.* 4, shows a Bacchante sitting between two fauns and holding a timbrel in her hand. One of the fauns stands with his left arm resting on his knee and his foot supported on a box, joking with the bacchante and offering her fruit in a bowl. The other faun, with his foot resting on a rock, touches the timbrel with one hand and points with the other to the broken fragments of a bowl. The female figure is white; all the rest is orange and black. The vase is 11 inches high. The vase-painting, *fig.* 5, represents Electra at the tomb of her father Agamemnon. Near her stands a large water vessel for libations, and beside it an unguent vessel and a girdle. Before Electra stands Orestes with a vase and a spear. He wears only a cap and a light cloak. The figure with the petasus (travelling hat) is doubtless Pylades; and the caduceus on which he leans points him out as a messenger. One of Electra's maids stands near. The whole is a scene from the Electra of Sophocles. The neck of the vase is ornamented with a combat between a horseman and a foot-soldier. On the vase *fig.* 6 there is depicted in the middle a sepulchral monument in the form of a little temple resting on a double substructure. In the interior is seen the deceased in a sitting posture, holding a jewel casket, and only covered with a light garment. Before her stands an attendant with a fan and a wreath of flowers. Near the monument stand a male and three female figures, who are bringing offerings to the dead, chiefly articles of female ornament. This vase, which is 2 feet, 2½ inches high, and is doubtless a cinerary urn, was once sold for 270 dollars.

Pl. 13, *fig.* 1, is a black vase 4⅛ inches high, on which a female head and

several ornaments are painted in white. *Fig.* 2 shows a vase on which is a Bacchante with a thyrsus and a wreath also; the other side of this vase is given in *fig.* 4, and shows a youth walking with a staff. *Fig.* 2 exhibits a cinerary urn with ornaments painted on it; and *fig.* 4 also a pitcher with a handle, on which is painted a priest sitting under palms. *Fig.* 3 is the reverse of the vase in *pl.* 12, *fig.* 5, and represents Iphigenia on the altar of Diana Taurica, and near her Orestes and Pylades. According to Millingen, the figure seated on an altar is Io (in which case the horn would indicate her metamorphosis into a heifer); she is imploring the protection of a king, behind whom appears a Satyr. A companion of Io is awaiting the event. Behind the altar stands on a pillar the statue of the goddess, near which hovers a winged genius.

Some of the vases have black figures on a red ground, others black or violet figures on a yellow ground, and others yellow or red figures on a black ground. Sometimes we find blackish or black vessels with figures and ornaments slightly raised or depressed. One of the finest vases was found in the year 1845 by Alexander Français, at Chiusi. It is very large and is now at Florence; it has black figures on a red ground, with white and red lights laid on and the finest sgraffito drawings accompanied by 115 Greek inscriptions relative to the mythological scenes (among which is the Wedding of Peleus and Thetis) and giving the names of the potter, Ergotimos, and of the painter, Klitias.

C. The Greeks and Romans.

Among the Greeks also painting became an independent art later than sculpture; which perhaps was partly owing to the fact that Grecian civilization had little need of it. Homer speaks only of garments with figures interwoven, of ships painted over, and of horse-trappings of colored ivory; and in his time, and doubtless long afterwards, painting consisted wholly in coloring images and reliefs of clay and wood. The first advances in painting are ascribed to the Corinthians and Sicyonians; and it is asserted, though without much credibility, that Cleanthes of Corinth invented linear drawing, that Cleophantes of Corinth was the inventor of monochromes, or paintings of single colors, and that Eumacros of Athens was the first who distinguished men from women in his drawings, perhaps by a lighter color.

In Corinth, where the manufacture of fictile vases attained such a pitch of perfection, we find the first union of painting with the art of pottery, which at the same time was in vogue among the Etruscans. The fabrication of vases was divided into two main branches: the light yellow vases without gloss, of broad and depressed forms, with red, brown, violet, and black figures, and animal shapes mostly of an arabesque character; and the red and dark yellow varnished vases, of a more tasteful form, and with black figures chiefly of a mythological nature. Both kinds were made in Greece as well as in Italy, and the oldest are distinguished by the rudeness and clumsiness of the figures, and especially by the stiffness of their attitudes, the scenes they represent belonging mostly to the Dionysan myth.

After the 50th Olympiad, the art of painting, by means of Cimon of Cleónæ and others, made very considerable progress, especially in the perspective treatment of subjects. Cimon of Cleonæ at that time painted in the Heræum the picture dedicated by Mandrocles the architect, which represented the bridge over the Bosphorus and the passage of Darius upon it. Vase-painting was more limited in its resources, and the prevailing species, with black figures on a dark red ground, exhibit all the peculiarities of the old style, viz. the excessive prominence of the chief muscles, the formal regularity in the folds of the drapery and the postures of the figures, and the angular abruptness of their movements.

In the period when Phidias, Praxiteles, Lysippus, and Leochares furnished specimens of the highest excellence in the plastic art, that of painting also attained, in three great stages, to a perfection which made it a worthy rival of sculpture. Ancient painting, however, remained always more closely allied to sculpture than that of modern times, by reason of the predominance of form over light and shade; the paintings of this period too are characterized by a certain separation of the figures in order not to confuse the outlines, a uniform distribution of light, and an avoidance whenever possible of foreshortenings.

The first painter of great reputation was Polygnotus of Thasus, who resided in Athens, and whose pictures are distinguished by accurate drawing, a noble and distinct mode of characterizing the mythological figures, and charming female forms. His great paintings were planned with an extensive knowledge of historical legends and according to architectonico-symmetrical principles. He was the son of the painter Aglaophon, and painted for the Pœcile, the Theseion, the portico of the Propylæa, the Delphian temple, &c. Pausanias has left us descriptions of these paintings, especially of those at Delphi; after which the brothers Riepenhausen have attempted to recompose them. Next to Polygnotus are placed Iphion of Corinth, Micon of Athens, Dionysus of Colophon, and many others; none of whom, however, equalled the first named master. The first who made a deeper study of the gradations of light and shade was Apollodorus of Athens, who is hence called the shadow-painter (sciagrapher). He formed his style after that of Agatharcos of Athens, who painted for the stage.

With Zeuxis begins the second period of improved painting, in which the art attained the power of deceiving the senses; we will allude only to the grapes of Zeuxis which the birds pecked at, and to the painted curtain of Parrhasius, which one of his brother painters tried to push aside in order to see the picture behind it. Zeuxis particularly excelled in the delineation of sublime majesty (Zeus on his throne surrounded by the gods) and female beauty (Helen at Crotona); while Parrhasius was preëminent for the rich variety of his compositions and the perfect appearance of roundness which he gave to his figures. Besides Zeuxis and Parrhasius, who formed the so-called Asiatic in contradistinction to the Attic school, Pamphilus originated the Sicyonian school, which was distinguished for scientific cultivation, and for accuracy and facility of drawing. Celebrated masters of this school, in addition to Pamphilus of Amphipolis, were Pausias of

Sicyon (figures of children), Euphranor of Corinth (heroes and gods), &c. At that time also (104th to 110th Olympiad) encaustic painting, if not invented, was considerably improved upon.

Before all, however, ranks the great Apelles, who united the advantages of his native Ionia, grace, sensual charms, and rich coloring, to the scientific severity of the Sicyonian school. His most charming picture was his *Anadyomene in Cos*, in the temple of Æsculapius, which was brought by Augustus to Rome, but was already quite decayed in the time of Nero. He showed that heroic subjects were also suited to his genius, and especially portraits in the grand style, as *e. g.* that of Alexander wielding the thunderbolts, of his father, and of his generals. Along with Apelles, Protogenes and Theon distinguished themselves. Much praise was bestowed upon the picture of *Nausicaa* by Protogenes in the portico of the Propylæa at Athens, in which was depicted a harbor with vessels of state, and upon the *Matricide of Orestes* by Theon. Of all these famous paintings we possess nothing but obscure accounts of authors and later imitations; yet the vase-paintings of this period, with their bright, thinly distributed figures on a dark ground, afford some idea of the degree of excellence attained in the art of correct design, if we may venture to draw conclusions from the works of simple artisans as to the productions of the first artists. Polychromes (paintings in several colors) are also found on the vases of this period. *Pl.* 14, *figs.* 1 and 2, are the two sides of a beautiful specimen of these vases 2 feet 7 inches in height. The front side relates to a festival of Bacchus. A young man holding a lance is seated on his chlamys, and his hat has fallen off; he is resting after a war-dance, such as was performed at the Dionysia. Near him is a clothed Bacchante holding a thyrsus and a laurel-branch. The picture on the reverse side likewise refers to these festivals. We have here a pair of Dendrophori, such as appear in the Dionysia, with branches of laurel and other trees. Rich ornaments accompany both pictures. *Fig.* 3 represents the pictures on a small vase 12¾ inches high painted with various colors. A woman is seated at a tomb, which she is adorning with various fillets by way of offerings to the dead, while a richly clothed young man, bearing two spears, points to the foot of the monument. The vase was found by Sir William Gell in Attica; its ground is a pinkish yellow, and the drawings and contours are laid on in red. In our copy all the half-shade tones of the figures and ornaments are bright red; those next dark are of a brick red; and the border of the youth's chlamys, the upper garment of the female, and the 2d, 4th, 8th, 12th, and 14th rings of the pillar, as also the ornaments *à la grecque*, are green. The neck and foot of the vase are black.

In the period of Alexander down to the destruction of Corinth, painting was zealously cultivated; yet none of the masters of the three above-named schools attained to the fame of their great predecessors, inasmuch as hasty painting, which the state processions in the cities where the rulers resided rendered necessary, spoiled many an artist. At this time too arose rhyparography (the painting of low life, as it is called), and scenography was applied to decorating the palaces of the great. As the love of splendor

now demanded that the floors as well as the walls should be decorated with colors, the mosaic art arose, which quickly developed itself, and undertook to represent great combats of heroes and animated battle scenes. The painting of fictile vases, on the other hand, ceased about this time: for we find none whose style indicates a later period of art. The first mosaic pavements were made by Sosos of Pergamus, and consisted of fictile cubes, which were mostly laid in beautiful patterns (*pl.* 13, *figs.* 19 and 21), although they often had a separate mosaic picture in the centre. One of these mosaics exhibited in the middle a cantharus (drinking-vessel) with doves drinking and sunning themselves, a picture which was afterwards repeated in the villa of Hadrian and is now preserved in the Capitoline Museum (*fig.* 17). Another centre-piece of a mosaic pavement of this sort exhibits several masks, an ancient imitation of which is now in the Vatican (*fig.* 16). Several of the decks in the state vessel of King Hiero of Syracuse were inlaid with mosaics. *Pl.* 14, *fig.* 6, is a copy of a very beautiful mosaic, now in the Villa Albani, which was found in 1760 at Arpino in the Kingdom of Naples, and on which is represented the deliverance of Hesione by Hercules. The hero has slain the sea-monster with arrows, and Telamon is helping Hesione down from the rock, on which we see the traces of chains. In the background appears a burning house, alluding to the destruction of Troy, whereby Hercules avenged the faithlessness of King Laomedon, the father of Hesione. Relief-mosaics were also made use of as medallions, of which the head, *pl.* 13, *fig.* 18, and the statue of Theodoric, of which we have already spoken, p. 47, are specimens.

The plunderings and devastations to which Greece was subjected and the transportation of its treasures of art to Rome, occurrences of which we have already treated in our history of the plastic art, produced also the downfall of painting in Greece, and the artists betook themselves to Rome, in which new abode Greek art is to be looked for from this time forth.

In the age of Cæsar the art of painting bloomed once more, but soon again faded. Subjects were then chosen of the deepest tragic pathos, as for instance the pictures by Timomachos of Byzantium, of *Ajax* and *Medea before the murder of her Children;* although portrait-painting was also much in vogue. Under the emperors we find the main branch of the art, easel-painting, entirely neglected; while wall-painting, as the handmaid of luxury, was practised in preference. Scenography, which, especially in Asia Minor, had taken a fantastic direction, and spurned all the rules of architecture, was transferred to the decoration of apartments, where it was developed if possible in a still more arbitrary manner; and artists pleased themselves with working up a transparent and airy architecture into forms of vegetation and other fantastic shapes. An example is furnished in the architecture of the two wall-paintings from Pompeii (*pl.* 12, *fig.* 8, a Roman priestess, and *fig.* 9 a songstress), where the excessively slender columns are crowned by the ornamental pinnacles which we have placed at the sides of the pictures.

A peculiar style of landscape painting was introduced in the reign of Augustus by Ludius, who produced wall-paintings containing villas, towns,

sea-ports, &c., animated with figures of persons engaged in all sorts of pursuits and often in very comical situations. In ancient buildings there are still many remains of this period of art, the date of whose execution extends down to the time of the Antonines. To these belong *e.g.* the paintings from the pyramid of Cestius, and the large and constantly increasing collection of wall-paintings from Pompeii, Herculaneum, and Stabiæ, as well as those in the tomb of the Nasones. In all of these the art exhibits, even in its degenerate state, an inexhaustible invention and productiveness: everything too is depicted with lively colors and simple illumination, and is clearly and agreeably arranged with much taste for harmony of color and a general architectural effect. We here furnish a few specimens of the painting of this period. The oldest is a painting found in one of the subterranean chambers in the garden of the Villa Pamfili in Rome (*pl.* 13, *fig.* 8); it is a fresco representing a satyric or comic scene, probably the flight of a Bacchante from a drunken Faun. The nuptial celebration, *fig.* 7, is of great antiquarian value, and is one of the finest fresco paintings that have come down to us from antiquity; it was found under Pope Clement III. not far from the Arch of Gallienus, near Santa Maria Maggiore and the Baths of Titus, and has been called, after the villa Aldobrandini, where it was afterwards preserved, "the *Aldrobrandini Wedding.*" This fresco is now in the Museum of the Vatican. Winckelmann explains it to be the wedding of Peleus and Thetis, at which the goddesses of the Seasons or three Muses are singing and playing the epithalamium. The bride seated on the torus is exhorted by Aphrodite or Peitho to receive the bridegroom who is waiting on the threshold. A charis stands ready to anoint her. In the back part of the chamber the bride's bath is preparing. Zoega and Heinrich Meyer perceive in the figures portrayed only ordinary mortals, and consider, no doubt correctly, that the whole is simply a representation of the Greek wedding ceremonials. The figures are rather more than two palms high, and are painted very lightly and thinly but with a fine feeling for harmony and the force of colors.

Of the innumerable paintings with which archæology has been enriched by the excavations in Pompeii, Herculaneum, and Stabiæ, we will mention only a few. To these belong, *e.g. Achilles and Briseis*, from Pompeii. We here behold the Peleide Achilleus seated on a throne against which leans the famous shield, and causing the weeping Briseis to be delivered by his friend Patroclus to the herald, near whom Mercury appears. It is interesting to compare this design (*pl.* 12, *fig.* 11) with the manner in which Thorwaldsen has treated the same scene in his relief (*pl.* 9, *fig.* 6). It having been declared by an oracle that Troy could not be taken without Achilles, but that if he went there he would meet with an early death, his mother Thetis disguised him in female garments and placed him at the court of Lycomedes king of Scyros. A painting from Pompeii represents his discovery there by Ulysses (*pl.* 12, *fig.* 12). The latter came to the court of the king disguised as a merchant, and proffered his wares, among which were some arms. As the women were inspecting the goods, he caused a trumpet to be suddenly sounded; the disguised Achilles unthink

ingly seized a sword in his martial zeal, and was thus detected. On the shield which the crafty Ulysses has brought with him we see Achilles in the act of being instructed by the centaur Chiron in the use of arms. More peaceful scenes are depicted on two other wall-paintings from Pompeii (*figs.* 8 and 9), taken from the edifice called the "Pantheon," which portray a priestess and a songstress surrounded by rich although fantastic architecture. In both pictures the drawing is excellent and the coloring beautiful; the combination of the colors too evinces much taste. Of the wall-paintings of Herculaneum we will instance only the picture of *Narcissus* (*pl.* 13, *fig.* 6), who, while gazing at his own image in the watery mirror, falls in love with himself, and wastes away with desire. In the background we perceive Cupid, who in silent sadness is casting away his torch, or an angel of death with his torch inverted. Another picture from Herculaneum (*pl.* 12, *fig.* 10) is a monochrome (a picture of one color), which represents *Theseus preventing the Rape of Hippodamia by the Centaur Eurytos.* The attitudes of Theseus and the Centaur remind one pretty strongly of Canova's famous statue of *Theseus slaying the Minotaur* (now in Vienna). A pendant to this monochrome is found in a painting executed in several colors (*pl.* 13, *fig.* 5), likewise from Herculaneum, which represents Theseus the slayer of the Minotaur receiving the thanks of the Athenian youth. As specimens of the manner in which the walls were divided for painting, we give (*fig.* 15) the painting on a ceiling, and (*pl.* 14, *fig.* 4) a wall in the sepulchral vault of the Naso family in the neighborhood of Rome. The former, which occupies about a third of the whole ceiling, shows in the central field, surrounded by rich ornaments, two dancing Bacchantes; and in the lateral fields a horse crossing a stream, and Mercury bringing the apple to Paris and summoning him to the famous judgment which resulted in the rape of Helen and the Trojan war. The wall-painting exhibits most probably in its principal field the forms of Ovid and his wife Perilla, accompanied by Mercury and the Muse Erato.

In the age of Hadrian, painting, along with the other arts, must have revived for a brief period, for Lucian mentions as belonging to this time the pictures of Ætion, which he ranks along with those of the best masters, and Hadrian himself was a rhyparographer. But after this the decline of painting becomes all the more rapid and perceptible; the earlier luxuriance of composition and of arabesque disappears, and a clumsy and poor simplicity joined to a sensual fondness for the delineation of the nude form takes its place. This is particularly conspicuous in the paintings of the time of the Antonines and of Constantine. We will here give some specimens of paintings from the baths of Titus and of Constantine. From the former are the two pictures in *pl.* 12, *figs.* 13 and 14; the former of which represents a rural scene, a father letting his two boys ride on a goat, while the mother beats a tambourine before them. In the second picture is represented a game of ball, probably that called by the ancients *pila trigonalis*, which was a sort of exercise usually taken before the bath. From the ruins of the baths of Constantine we take two representations of Apollo, the Pythian (*pl.* 13, *fig.* 9) with his bow and arrow, and the

Delphian with his lyre; also two nymphs or dancing girls (*figs.* 11 and 12) as parts of arabesques, an Amorette with bow and arrow (*fig.* 13), and another climbing after a fruit (*fig.* 14); and lastly the mosaic floors (*pl.* 13, *figs.* 20 and 22) from the Basilica, which will sufficiently confirm our assertion respecting the meagreness of the style and the poverty of the arabesques.

2. The Middle Ages and Modern Times.

We can very fitly divide the painting of the middle ages and modern times into two periods, of which the first extends to Cimabue, the precursor of the modern period, while the latter embraces the modern and the latest times.

A. From the Introduction of the Christian Religion down to Cimabue (*d.* 1300).

With the downfall of the blooming mythology of antiquity, there appeared in its place a more earnest and simpler religion, which, while in itself less adapted to embodiment in visible forms, was not yet sufficiently elaborated for introduction into the domain of art. On the cessation of the living study of nature and the decline of all higher technical skill, the arts naturally sank, and of course painting among them, to a lower and lower ebb. Still there was zealously preserved a sort of manual skill of the painter and sculptor, which had assumed the nature of a handicraft, along with the principles and forms of ancient art. Christianity first appropriated to its own use the forms and even many of the subjects of ancient art, and gradually shaped for itself, and not without artistic feeling, a cycle of images of its own, whose introduction however was opposed by the repeated assaults on works of art of which we have already spoken in treating of sculpture. In the Christian church there arose by degrees fixed and standard forms for the holy personages, a process which was furthered by the supposition, that by going back to the oldest representations the actual form was preserved. The faces, although rudely executed, were shaped after an ideal fundamental form; the costume in the main was Grecian; and the drapery was thrown into great masses, after the ancient manner. It was not till long afterwards that the peculiarities of the middle ages in dress and gestures penetrated into the world of antiquity. But nowhere do we perceive an independent treatment of nature, the renewed study of which in the 13th and 14th centuries produced a fresh revival of art, and at the same time liberated it from those typical and lifeless forms which are still preserved in the pictures of the Greek church as the last relics of a perished world of art. The pictures which have come down to us from these times are chiefly mosaics, and in fact it appears as if the mosaic art had almost entirely superseded painting with the usual colors; for with the exception of the illuminations of the latter centuries of this period no pictures hardly

but mosaics have come down to us. Thus in the reign of Justinian, John, bishop of Naples, caused a mosaic representing the *Transfiguration of Christ* to be executed for the Basilica Stefania; and even still earlier, Paulinus bishop of Nola (431) had the portico of the Basilica of St. Felix adorned with paintings, in which instead of encaustic (*cera liquens*) mosaic was employed. About the year 441, in the reign of Sixtus III., were begun the mosaics in the Basilica of St. Paul on the road leading to Ostia; and in 462, under Pope Hilarius, those of the church of St. John in the Lateran; and under Simplicius, those of Santa Maria Maggiore. The mosaic fragment representing the head of the apostle Paul, which we have copied (*pl.* 14, *fig.* 7), is from St John's in the Lateran. It is preserved in the Triclinium of Pope Leo.

In like manner the succeeding popes proceeded to adorn the churches partly with mosaic and partly with fresco paintings, although of the latter we have gradually fewer and fewer. Thus art is greatly indebted to the popes, who alone prevented its utter extinction in those barbarous centuries, and encouraged the other clergy to imitate their example. It is on this account that all the artistic productions of those times are to be sought either in the catacombs or in the churches. That art notwithstanding made no considerable advance, is easily conceived; and if the reliefs on Trajan's Column, one of which, *viz.* Trajan receiving the submission of a vanquished king, we have copied in *fig.* 8, be compared with the mosaics of the 8th century, *e. g.* that of Christ sending forth the Apostles (*fig.* 10), now to be found on the Triclinium of Leo IV. in St. John's in the Lateran, the beholder cannot but remark a considerable decline as respects both composition and drawing. With what rapid strides this decline must have proceeded is shown by a comparison of the above mentioned mosaic of about the year 797 with the mosaic executed in 705 for the Basilica of St. Peter and now preserved in the church of Sta. Maria in Cosmedin (*fig.* 9), which represents the *Adoration of the Magi*, and in which many beautiful points can still be observed that characterize the work of Greek artists, in whose hands the practice of art then almost exclusively lay.

Art remained at the same point down to the 10th century; the mosaic copied in *fig.* 12 will give an idea of the skill of that period. It was executed at the close of the 10th century; for it formerly adorned the tomb of the emperor Otto II. (d. 983), which stood under the portico of the old St. Peter's church, and is one of the few works of art that were saved when that church was hastily pulled down. It is now preserved in the crypt of the present St. Peter's. The picture represents Christ between the apostles Peter and Paul; and singularly enough Peter appears with three keys, of which the learned have never yet given a satisfactory explanation, although they regard it as a symbol of the closer union of celestial, terrestrial, and spiritual power.

After this period fresco-paintings begin again to occur in greater numbers, while traces of easel-paintings likewise make their appearance once more. Thus Pope Calixtus, when in 1120 he took prisoner the anti-pope Bordino, commemorated the event by a painting in the chambers of the Vatican; and Clement III. caused the Lateran palace to be repaired and adorned with pictures.

Of the mosaics of that time a specimen is furnished in the Christ's head (*pl.* 14, *fig.* 11) from the church of San Miniato in Florence, which was executed in 1196, and which Vasari describes as one of the works that already exhibit an advance towards perfection in art.

The miniature paintings or illuminations of the last centuries were properly the form in which easel-painting had taken refuge after being supplanted by the frescoes and mosaics; and thus ancient manuscripts furnish us with an opportunity of observing and studying the gradual decline of art. *Figs.* 5[a] and 5[b] are specimens of this class of paintings belonging to the 8th century. They are taken from a Greek manuscript, formerly in the library of the Elector of the Palatinate in Heidelberg, but now in the Vatican. The entire painting, of which we present here only a fragment, portrays the history of Joshua in a series of representations, which, like the reliefs on Trajan's column, form a continuous band. The portion here copied begins with Josh. ix. 22, 27, where Joshua detects the artifice of the Gibeonites, but pardons them and condemns them to bondage to Israel. Next we have Joshua's battle with the five kings of the Amorites, where, in order to complete his victory, he commands the sun and moon to stand still (x. 12, 13). Joshua takes the kings of the Amorites in a cave (x. 17, 18); when he has destroyed their army, he causes them to be led forth, and orders all the men of Israel to put their feet upon the kings' necks (so far *fig.* 5*b*), after which he orders them to be hanged (*fig.* 5[a]).

About the year 1200 mention is made of a Greek painter Theophanes, who settled in Venice and there established a school of painting; among his pupils was one Gelasio of Ferrara. About the year 1219 a painter named Tullius of Ferrara executed a picture of *St. Francis of Assisi;* and another of the same saint was painted by Bonaventura Berlinghieri. We now gradually approach the time when the history of the arts presents us with living and breathing monuments. To these belong *e. g.* the works of Guido of Siena, of Andrea Tafi, Buffalmaco di Giunta of Pisa, Margheritone of Arezzo, and lastly of Cimabue, the father of modern painting, who first discarded those hardnesses which are usually characterized as the Greek manner. His paintings manifest independent study and give some indications of chiaroscuro. His first great picture, a *Madonna on the throne*, is in the church of Sta. Maria Novella in Rome; and in that of San Francesco in Assisi he painted several holy figures and histories. What is shown in galleries under his name is certainly not by him.

B. From Cimabue to the latest Times.

Although Cimabue is doubtless to be regarded as the father and precursor of modern painting, we are not to suppose that immediately before him there were no Italian painters; nevertheless at that time there was no acquaintance with the ancient pictures or the ancient statues, and the only subject of study for the artist was nature. In the works of Giotto, a pupil of Cimabue, we already observe an admirable use of the study of the productions of ancient art; here consequently the hardened and angular taste ends, and Italian art begins. The most celebrated painter who appeared immediately

after Giotto was Masaccio, who flourished about the year 1400; his contemporaries were Domenico of Venice, Vittore Pisano (Pisanello), Squarcione, Mantegna, and several others, who by their example and instructions educated the great painters of the 16th century (the *cinquecentisti*). We see in Masaccio's pictures not merely bodies in motion, but these bodies have souls which breathe through their movements, while the figures are better brought out by means of good drawing and a proper distribution of light. In this period they first painted *a tempera* (in which the colors were mixed with the white of an egg), and it was not till afterwards that they began to paint in oil on wood, plaster, and at length on canvas.

1. Italy.—*a. The Roman School.* We reckon among the painters of the Roman school those born not only in Rome itself, but also in the Romagna or anywhere in the States of the Church, and this we are in a manner compelled to do as Rome has almost nothing of its own to show in the way of talent for painting; and hence it was much later than in Florence and elsewhere, and not till the reign of Julius II., that art actually flourished there. The Roman school may be said to begin with Oderigi of Gubbio, who died in 1300 and was a good miniature painter: he along with Giotto and Franco Bolognese ornamented books with illuminations for Boniface VIII. He was succeeded by Guido Palmerucci and Pietro Cavallini, who lived about the year 1342, and by whom pictures are still extant in Rome, Assisi, and Florence. A favorite subject with artists at that time was the Annunciation. In these paintings the angels are always represented as youths with long flowing garments reaching to the feet and with a staff in their hand; for the light drapery of angels belongs to a much later date. Almost all the painters of that period added to their pictures legends in Gothic characters. To the 14th century belong Boccardo Fabriano, Allegretti Nutti, Andreas of Velletri, and several painters in Perugia. The series of painters of the 15th century opens with Octavian Martis and Gentile of Fabriano, whose distinguished merits were afterwards acknowledged by Michael Angelo himself. He was the instructor of Giacomo Bellini, whose sons Giovanni and Gentile are regarded as the founders of the great Venetian school. There are still good pictures in Florence by Gentile da Fabriana of the year 1423. His style was noble, and may be compared to that of Giovanni da Fiesole, only the latter excels him in the beauty of his female forms and uses gold less profusely.

A characteristic difference between the pictures of this and the succeeding time is perceived in the grouping of the figures, the former exhibiting great simplicity in this respect, while the latter observe an almost stiff and rigidly symmetrical arrangement, which extends even to minute details. This was particularly the case in the time of Perugino, and even Raphael could not for a long time free himself from it.

At the close of the 15th century Urbino was not destitute of good painters; among these are distinguished Lorenzo di San Severino and the father of Raphael, by whom there is an Annunciation in the chapel of St. John in St. Sebastian and in Sinigaglia, bearing the superscription "*Joh. Sanctis Urbin.*" The style of this painter is dry, but shows already an

approximation to that of Pietro Perugino. The works of Fra Bartolomeo Corradini of Urbino are full of fire and vivacity, and he originated the practice of introducing portraits into historical compositions, which was afterwards adopted by Raphael. Excellent painters flourished at this time in Perugia; and when Sixtus V. set about adorning the Vatican with pictures, he obtained most of his artists from this place. Among them were Benedetto Buonfigli, whose works are highly esteemed, and Pietro Vanucci (born 1446 in Citta della Pieve, died 1524), called Pietro Perugino. Whoever has seen the works of this last artist must confess that his merit does not consist solely in having been Raphael's instructor; but that his pictures exhibit grace, his attitudes are dignified, and his coloring lovely, although he is not yet free from the defects of his age. His best work is preserved in the Sala del Cambio in Perugia; he, however, was not fertile in invention and repeated himself very often. His pupils spread themselves over all Italy; we will mention only Guerino of Pistoja, the brothers Ubertino, Montevarchi, and Zoppo in the Tuscan school, and in the Roman Bernardo Pinturicchio and Sinibaldo of Perugia, which last, however, did not equal their master in excellence, although they were almost his mechanical imitators, for instead of regarding Pietro's instructions as good foundations on which to build, they made them an easy cushion to recline upon. But all Pietro's pupils did not adopt this course of stupid imitation; and had not Andrea Luigi of Assisi early lost his sight, he would certainly have become a formidable rival to Raphael. His extraordinary talents gained him the cognomen of *l'Ingegno* (the Genius), and Sandrart has erroneously ascribed to Raphael several of his works. Domenico Alfani also worked in an independent spirit, greatly resembling Raphael, only weaker in coloring. His reputation has been outshone by that of his son Orazio Alfani, who in after times greatly distinguished himselt, and to whom many of his father's works are attributed.

Raphael Sanzio (Santi), one of the greatest painters of modern times, was born at Urbino, on Good Friday, the 28th of March, 1483; and even in his boyhood, when his father gave him instruction in the first principles of drawing and painting, he manifested such surprising abilities, that his father took him at once, in 1492, to Pietro Perugino in Perugia. He was soon engaged, along with Pinturicchio, in painting the Library at Siena; after which he went, in 1503, to Florence, where a new light broke in upon him from the works of Masaccio, and caused him to relinquish the somewhat vague manner of his master. During his abode in Florence he is said to have become acquainted with Leonardo da Vinci and Michael Angelo. He next went in 1508 to Rome, where he was commissioned by Pope Julius II. to paint in fresco the Stanza della Segnatura. He lived on terms of the closest intimacy with Count Castiglione, Cardinal Bembo, and several poets and authors, and was a most amiable man. Towards his pupils especially, of which he had a great number, he was courteous, friendly, and ever ready to advise and assist. His constantly increasing fame procured him great commissions. Thus he worked in 1517 for Francis I. of France and painted several pictures for him, as the Arch-

angel Michael, &c., but declined an invitation to the French Court. Raphael was never married, although he had been betrothed since 1514 to Maria niece of Cardinal Bibiena. In the year 1515 he received, after Bramante's death, the charge of conducting the erection of the church of St. Peter, as also the superintendence of the antiquities in Rome. In 1517 he had drawn the Cartoons for the tapestries in the Vatican, on subjects taken from the Bible, seven of which are still preserved in Hampton Court, and had painted the Christ bearing the Cross (*lo Spasimo di Sicilia*) now in Madrid. He then accompanied the Pope to Florence, where he painted him along with Giulio de' Medici and De Rossi (this picture is now in the Pitti Palace in Florence). In consequence of the increasing number of orders which he received, he could only sketch most of his pictures and put the best touches to them, intrusting their execution to his pupils. His restless activity so undermined his health, that he died on Good Friday in the year 1520. He was buried in the Pantheon by the side of his betrothed. His most distinguished pupils were Giulio Romano and Francesco Penni, whom he made his heirs and to whom he left the completion of his works. His last picture is the *Transfiguration*, for which he received 655 ducats. His principal works, passing over his earlier ones executed under Perugino, were: the *Marriage of Mary* (*lo Sposalizio*), in Milan; the *Madonna del Granduca* (in the Pitti Palace in Florence); the *Holy Family*, for Canigiani (in Munich); the *Entombment of Christ* (Borghese Gallery in Rome); the *Holy Family* and the *Madonna among the Flowers* (*la belle Jardinière*) in Paris; the fresco paintings in the *loggie* of the Vatican, consisting partly of arabesques, of which we have given fragments in *pl.* 17, *figs.* 1 *a* and *b* and 2 *a* and *b*, and in *pl.* 16, *figs.* 3 and 4, and partly of large historical compositions from the Bible (*Raphael's Bible*). The arabesques are sketched and painted with a rich fancy and with transcendent beauty, and they form an inexhaustible study for ornamental designers. Of the historical paintings several were executed by Raphael's pupils. Of the pictures in the halls of the Vatican we copy one, the *School of Athens* (*pl.* 15, *fig.* 1), which is equally celebrated for its composition and execution. In these halls are seen also the *Dispute of the Fathers;* the *Parnassus* with poets of ancient and modern times; *the Expulsion of Heliodorus from the Temple*, *the Mass of Bolsena*, *Attila's Retreat from Rome*, *the Conflagration of the Borgo*, &c., pictures in the execution of which Raphael's pupils also took part. Besides these Raphael painted *Galatea* and the fable of *Psyche*, in the Farnesina; the *Sybils*, in the church of the Madonna della Pace; the *Madonna and the Fathers of the Church* (*pl.* 18, *fig.* 1); the *Madonna col Pesce* (in the Escurial, Madrid); *St. Cecilia* (*pl.* 16, *fig.* 1) *with St. Paul*, *St. John*, *St. Augustine*, *and St. Magdalen* (in Bologna); a *Madonna and Child* (*fig.* 2), the famous *Madonna della Seggiola*, *Leo X. with his Cardinals*, and the *Vision of Ezekiel* (in the Pitti Palace in Florence); the celebrated *Madonna di San Sisto* (in Dresden), the *Transfiguration* (in San Pietro in Montorio), and the above mentioned Cartoons in Hampton Court, the tapestry woven after which cost 70,000 scudi, and is still in Rome. His portrait,

painted by himself (*pl.* 17, *fig.* 3), is in the Uffizi in Florence. Three successive manners have been pointed out in Raphael's pictures: one rather stiff and meagre, and dry in its coloring, which he derived from Perugino; another freer and formed on the study of the antique, in which blooming colors, graceful forms, and tastefully arranged draperies predominate; and the last a grandiose style, in which the form prevailed more and more over the "motivo," and the feeling for ideal beauty became the measure of its characteristics. In the technical part of his art he may be said to have been perfect, especially during the latter part of his career.

The most distinguished among Raphael's pupils is Giulio Pippi, called Giulio Romano (born 1492, died 1546), to whom he left a third of his estate. Giulio worked constantly under Raphael's eye, and hence it was not till his master's death that he assumed a manner of his own. His fiery imagination led him not unfrequently into exaggeration; and thus he formed a style of painting strongly tinctured with mannerism, which found but too many adherents. As a proof of the quaintness and affectation that pervaded Giulio Romano's works, we copy his picture of *Venus and Vulcan arming Cupid* (*pl.* 16, *fig.* 6). In Rome he painted the grand hall of Constantine, and then entered the service of the Marchesa Gonzaga in Mantua. Here he built the Palazzo del Te, which he also, with the assistance of his pupils, beautifully decorated. Among his paintings his *Fall of the Giants* is particularly celebrated for its original composition and the boldness displayed in the postures of the naked body. His co-heir and fellow-pupil was Gianfrancesco Penni (called *il Fattore*, born 1488, died 1528), who had been with Raphael from his boyhood. His style was a mixture of that of Raphael and of Michael Angelo. Giovanni Nanni (da Udine, born 1494, died 1564) distinguished himself by the arabesques painted by him in the loggie of the Vatican after those found in the Baths of Titus. Pietro Buonacorsi (Perino del Vaga, b. 1500, d. 1547) also worked on these arabesques; he likewise painted a great deal after Raphael's sketches and designs, and his coloring is admirable.

In the death of Leo X. painting at Rome received a severe blow; for Hadrian VI. was an enemy to the fine arts, and immediately put a stop to all the works in the Vatican. This occasioned the dispersion of Raphael's school; but they were at length employed again to some extent under Clemens VII., on the occasion of decorating the Villa Madama. It was about this time that Michael Angelo, in Florence, who as early as 1503 had developed a style in which he alone could attain perfection, and in which beauty, grace, coloring, and chiaroscuro were sacrificed to anatomy and to the perspective foreshortening of the figures, came to Rome. As long as Raphael lived, this style, which must have excited more astonishment than admiration, found little acceptance in Rome; and even during the life of Clement, it provoked attacks which were extended to the master himself. The work in which Michael Angelo's peculiarities made themselves most conspicuous, and which gave the most violent blow to correct taste, was *the Last Judgment*, completed under Paul III.: it produced such a revolution in the Roman school, that all became little more than

copyists of Michael Angelo, mannerists who mixed up his style with their own, by some of whom the manner of the great master was degraded to caricature. There were but few who, true to the precepts of Raphael, strove to combine with his grace the seriousness of Michael Angelo; and still fewer was the number of those who steadfastly adhered to the genuine Roman school. One of the best and most celebrated masters of that time was Federico Barozzi (born 1528, died 1612), who had formed his style on that of Titian, and afterwards on that of Raphael. His best pictures are a *Descent from the Cross* in Perugia, and a *Laying in the Tomb* in Sinigaglia.

In the first third of the 16th century, the state of painting in Rome was very critical. The corruption of taste gained ground daily, and painters, no longer concerning themselves about thorough preparatory studies, merely strove to acquire an easy dexterity; so that painting became almost a simple mechanical art, and fantastic conceits remained the only means of obtaining a certain repute. The style of Raphael was no longer known, and the highest attempts were confined to different imitations of Michael Angelo. Venice possessed good colorists; but this had no influence on Rome, where everything, even chiaroscuro, was neglected. The only painter of note at this time was Giuseppe Cesari, called il Cavaliere Giuseppino; for then every painter possessed of a little talent and considerable popularity was dubbed *chevalier;* which induced Salvator Rosa in his pictorial Satire to call this "the chevalier age of painting." He had a great deal of fire; but his compositions are crowded and unnatural, and his coloring only tolerable. It was reserved for Michael Angelo Amerighi da Caravaggio to combat the monster of mannerism and lead painters back again to the study of nature, although he toò went to extremes. To the painters who resigned themselves the most completely to the perverse taste we have spoken of, and who debased their fine talents to the production of wretched caricatures, belongs Peter Laar (il Bamboccio), who created a *genre* of his own, which unhappily found in Rome both patrons and imitators (Bambocciadi).

Andrew Sacchi was a contemporary of Laar, but an artist of a different stamp inspired with the true spirit of the Roman school. His *Vision of St. Romualdo* is one of the four finest paintings in Rome; the others are *the Transfiguration* by Raphael, *the Descent from the Cross* by Daniel of Volterra, and *the Communion of St. Jerome* by Domenichino: there still exist in Rome many beautiful paintings by this master. His drawing is remarkable for correctness and breadth, his draperies are artistic and dignified, and everywhere we perceive in him a profound study of nature. Richness of composition was his most prominent characteristic. The most celebrated of his pupils was Carlo Maratti (born 1625), who from his boyhood displayed a remarkable talent for painting. His first work given to the public was a *Christ in the Manger* (1650). Pope Clement IX. showed him marks of favor, and Innocent IX. made him superintendent of the Vatican chambers. Our best information as to the course of his studies is furnished by a drawing which he made for the Marchese del Carpio and which has been engraved by Dorigny. In this drawing Maratti depicted an academy, in which a number of persons are engaged in the studies per-

taining to painting, as geometry, perspective, anatomy, &c. On the part where perspective, anatomy, and geometry are taught, stand the words, "*Tanto che basti*" (As much as suffices); on the other side we perceive the most beautiful antiques, with the inscription, "*Non mai abastanza*" (never enough); and in the clouds appear the Graces, with the inscription, "*Senza di noi, ogni fatica è vana*" (Without us all labor is in vain). That he himself practised these doctrines is evident from his pictures, of one of which, *the Distribution of the Holy Rosaries*, we have given a sketch (*pl.* 16, *fig.* 5). Richardson calls Maratti the last painter of the Roman school; he died in 1713.

With the advent of the Bolognese school or school of the Caracci, true taste again obtained a firm footing in Rome; but even these Bolognese and Lombards formed schools differing to a certain extent from each other. Domenichino studied Raphael and the antique; Guido Reni created for himself an original style of apparent facility opposed to that of Caravaggio; Barbieri combined the two; Albano worshipped the Graces chiefly; and Lanfranco formed a mixture of Caracci and Correggio. The most eminent artists of Rome at that time were Canini a pupil of Domenichino, Cerrini, Scaramuccio, Michelini, Sacchi, and Giambattista Salvi (il Sassoferrato), who was born in 1605, studied under Domenichino, Guido, and Albano, and who approximated to the last mentioned especially in the great pains which he bestowed on his execution. He painted only small objects; but his small heads and half figures are equally worthy of esteem for their delicacy of execution and their lovely and noble expression, with the works of Carlo Dolci. We give by way of specimen a sketch of a *Praying Madonna* by Sassoferrato (*pl.* 15, *fig.* 9).

There is a master whom we must mention here although he did not take pattern much by Raphael, the great exemplar of the Roman school, and that is Pietro Berettini, usually called da Cortona. He came to Rome at a very early age, and formed for himself a style still more facile and more calculated to please the multitude than that of Lanfranco. He painted a great deal in Rome and in Florence, especially in the Pitti Palace, from which we have copied the representations of the Muses *Polyhymnia and Erato* (*pl.* 16, *fig.* 9), and *Euterpe and Urania* (*fig.* 10), painted by this master. We shall return to him again.

In order to furnish a complete view of the history of art in this age it is necessary to say something of Giovanni Lorenzo Bernini, of whom we have already spoken repeatedly under Architecture, and in the section on Sculpture, as he was both a painter, a sculptor, and an architect. In Bernini's works there is a straining after the effects of chiaroscuro, to which truth and beauty of form are sacrificed; and in consequence of the great marks of favor that were bestowed upon him and the power that he acquired, most of the painters living at that time were obliged to adopt his manner if they wished to be employed at all. Among the chief principles laid down by the followers of Bernini were the following: extensive studies are of no avail; to successfully imitate nature and please the eye is always sufficient; and he who is a master of coloring possesses

ninety-nine out of a hundred requisites for a painter. Under such auspices true art could not prosper in Rome, and hence even the masters after Bernini are scarcely worthy of mention. Venesiale and Batoni were the first again to leave the beaten track.

Pompeo Girolamo Batoni (b. 1708, d. 1787) came to Rome when very young and became a pupil of Masucci; but being endowed with extraordinary talents, he soon perceived that Raphael, nature, and the antique were the surest guides in the domain of art; and hence the study of nature makes itself conspicuous in all his pictures. We discern it in his pleasing and varied physiognomies, his movements and attitudes; and even in disposing the folds of his draperies he was able to snatch from nature a certain pleasing grace, of which his *Magdalen* in the Dresden Gallery furnishes a beautiful example.

The second restorer of art in Rome was Anton Raphael Mengs (b. 1728, d. 1779). He was born in Aussig in Bohemia, and his father, himself a good miniature painter, destined him to painting, so that in his sixth year he was obliged to draw and in his eighth to paint in oil, miniature, and enamel. He was kept to study with almost unheard of strictness: and when his father observed his great progress, he in 1741 took him from Dresden, where he had hitherto studied, to Rome, and there, the lad being now in his thirteenth year, he judiciously made him copy at first after the antique, then after Michael Angelo in the Sixtine chapel, and lastly after Raphael, treating him all the while with the same severity as when a boy.

Mengs spent three years at these studies in Rome; at the expiration of which time his father took him back to Dresden, where king Augustus III. gave him a yearly allowance of 600 thalers. With this Mengs, his father, and two sisters went again to Rome. Here he studied four years longer, giving especial attention to anatomy; and then at length he made his appearance publicly with a *Holy Family*, which obtained universal applause. About 1749 he returned once more to Dresden, where he became court painter with a salary of 1,000 thalers, and was commissioned to paint the altar-piece for the new Catholic church erected in 1751, a work which he executed in Rome, whither he returned in 1752. As during the Seven Years' War his salary was no longer paid, Mengs painted in fresco the ceiling of the church of St. Eusebius in Rome. This was again the first work of the kind in Rome, where fresco painting had not been practised for a long time, and Mengs gained by it great applause. He painted for the villa of Cardinal Albani a ceiling, on which he represented *Apollo and the Nine Muses*.

In the year 1761 Mengs entered, with a yearly salary of 2,000 doubloons, into the service of the king of Spain; and there he began a ceiling for the king's chamber representing the *Assembly of the Gods:* he also executed many other admirable works there, among which a *Descent from the Cross* is especially celebrated. From this time forward Mengs resided alternately in Rome, Madrid, Florence, and Naples, working very diligently, until consumption, brought on by his incessant labors and the climate of Spain, which did not agree with him, snatched him from the world. No diminution of power is observed in his works to his latest moment.

Were we to institute a comparison between Batoni and Mengs, the two restorers of painting in Rome, we could not do better than adopt the words of Chevalier Boni, who says: "Mengs was made a painter by philosophy, and Batoni by nature. Batoni had a natural taste which led him to the beautiful without effort; Mengs attained the same object by reflection and study. The gifts of the Muses belonged by nature to Batoni, as they formerly had to Apelles; while the highest attainments of art were allotted to Mengs, as in former days to Protogenes. The former perhaps was more of a painter than a thinker, the latter more of a thinker than a painter. The one perhaps was more perfect in his art, but more studied; the other was less profound, but more natural." It is but justice to add, however, that Mengs's mannerism and unnatural coloring place him much below the first artists of the present day.

b. The Florentine School. Cimabue was looked upon by the Florentines as a prodigy when he ventured to lay aside the Byzantine manner and give more movement to his figures. At the time when king Charles, the brother of St. Louis, was crowned king of Sicily, he was shown as a great curiosity the picture on which Cimabue was then engaged, a Madonna and Child accompanied by six angels. This picture is still preserved in the church of Sta. Maria Novella. Among the contemporaries of Cimabue deserving of notice are Ugolino of Siena and Gaddo Gaddi, from whose school proceeded a great number of painters. Here too belongs Giotto, born in Vespignano in the year 1276. A sheep which he had drawn on a flat stone while tending his flock had attracted the attention of Cimabue; the latter took him home to educate him as a painter, and so rapid was his progress that the pupil soon surpassed his master and applied himself with equal success to sculpture and architecture. Art is greatly indebted to Giotto, especially in respect to drapery, expression, grace, and softness, and because he was the first to venture on foreshortenings. Among the most important works of Giotto are the *Histories from the life of St. Francis of Assisi* and *Entombment of the Virgin* in Florence. Among the pupils of Giotto we may mention Taddeo Gaddi, Puccio Capanna, and Stefano of Florence, who endeavored to surpass his master, and whose pupil Maso or Tomaso painted a *Madonna della Pietà* in Florence and several frescoes in Assisi.

From this time onward art kept constantly ascending to higher flights through the exertions of Memmi, Angelo Gaddi, Barocchio, Giovanni da Fiesole, and others; with Masaccio the last remnants of the ancient stiffness and constraint disappeared, and art soared aloft at length with perfect freedom. Masaccio, whose real name was Tomaso Guidi, was born 1402 in St. Giovanni in the Val d' Arno, and his chief study was nature, which he portrayed with grace and spirit. He died in 1443, and was succeeded by Filippo Lippi and Andrea del Castagno, who introduced into the Florentine school the art of oil-painting, invented by Johann van Eyck, a Fleming, after he had wormed the secret out of Domenico Veneziano and then murdered him.

Among the pupils of Filippo Lippi those who distinguished themselves were Sandro Boticelli and Luca Signorelli, especially the latter, who, according to Vasari, first paved for artists the way to perfection, by

developing the true principles on which the representation of the nude figure depends, and basing it on the study of anatomy. But a more special notice is due to Domenico Ghirlandaio (properly Bigordi), who was born in Florence in the year 1451; for he, of all the painters who then labored in the Sixtine Chapel, is the only one who can compare with Pietro Perugino. He possessed facility and richness of invention, drew diligently and correctly, and was so well acquainted with perspective that he ornamented his backgrounds with buildings properly diminished. His *Death of St. Francis*, in the church of Sta. Trinità in Florence, is celebrated. Ghirlandaio was the instructor of Michael Angelo.

Leonardo da Vinci (b. 1444, d. 1519) was the son of a notary in Florence, and was placed under the charge of Barocchio, to receive instructions in drawing, but he soon surpassed his master. Even in early life he pursued with distinguished success a number of almost incompatible studies; and in the year 1482, Ludovigo Maria Sforza, duke of Milan, invited him into his service, where he became the founder and superintendent of an academy of design. Among the pictures he was commissioned to paint for the duke the most celebrated is his *Last Supper* in the refectory of the Dominicans of Sta. Maria delle Grazie in Milan, a picture unfortunately which is now almost completely obliterated, but which can still be studied in good copies by pupils of his, viz. by Bernardino Luino and others, as also in good engravings, the finest of which is by Raphael Morghen. When Leo X. was elevated to the papal throne, Da Vinci accompanied duke Julius of Milan to Rome; but as, on account of the rivalry of Michael Angelo and Raphael, no considerable works were intrusted to him, he went in his old age (in 1515) to France, whither he was invited by Francis I. but where on the whole he wrought but little. As respects the peculiarities of his works, some are distinguished for strong shadows which bring out sharply the contrasted lights, as for instance in Leonardo's own portrait, while in others free play is given to the half tints, as *e. g.* in the *Madonna* in the Albani palace. Leonardo was indefatigable in his studies even to an advanced age, and was never satisfied with his works, on which account but few are known which he finished completely. Among his celebrated productions are *Lisa del Giocondo*, a picture purchased by Francis I. for 4000 scudi; a *Leda*, now in Vienna; *Christ teaching in the Temple*, in the Pamfili palace in Rome; and *Herodias with the head of St. John the Baptist*. As a specimen of Da Vinci's beautiful compositions we have given a sketch (*pl.* 15, *fig.* 2) representing the *Madonna and Child*, to whom the archangel Michael is bringing the scales of justice, with St. Elizabeth and the youthful John the Baptist near them. In addition to his pursuits in painting and many other studies, Leonardo also employed his time in literary works, and sixteen volumes of his manuscripts are preserved in the Ambrosian library at Milan. Unfortunately none of these but his treatise on painting have appeared in print; on the other hand there are many drawings and engravings after his works which furnish admirable studies for the draughtsman.

The number of Da Vinci's pupils was very great; but the most distinguished among them was Baccio della Porta, who was born in 1496 in the

neighborhood of Florence. His family name is not known; for the name della Porta was given him from his residence at the gate of San Pietro Gattolino. This artist however is best known by the name of Fra Bartolomeo di San Marco, which he assumed on joining the order of Dominican monks at the advice of the fanatic Savonarola. Fra Bartolomeo became afterwards an intimate friend of Raphael, and each learnt from the other, the latter from the former his lovely blending of colors, and Fra Bartolomeo from Raphael perspective. During his stay in Rome Fra Bartolomeo began two pictures, which were afterwards finished by Raphael and are now in the palace of Monte Cavallo. His pictures are beautiful in composition and execution, and grand in style; his draperies in particular are admirable. He is said to have attained to this excellence in drapery by the invention of the lay figure, which is ascribed to him; at any rate Vasari affirms that he himself had in his possession the first model which Fra Bartolomeo caused to be made. One of his grandest pictures is his *St. Mark* (*pl.* 15, *fig.* 4), now in the Pitti palace, and which certainly is not inferior to Raphael's *Isaiah* in the church of the Augustines in Rome. Fra Bartolomeo first sketched his pictures in various shades of grey, and he as well as Raphael first drew his figures without drapery, as appears from many drawings by both artists which are still extant. The finest pictures of this artist belong to the Florentine Museum; among them is that of the *Virgin Mary* in the temple, of which we have given a sketch (*pl.* 18, *fig.* 2). One peculiarity of the pictures of this great master is a sort of haze he had the art of spreading over his figures, and which made them appear as if stepping forth from the canvas. Fra Bartolomeo died in 1517.

Rudolpho Domenico Ghirlandaio distinguished himself among Fra Bartolomeo's pupils, at least he formed himself closely upon his master's model, although his pictures evince likewise a profound study of Raphael. Ghirlandaio never left Florence, although Raphael repeatedly urged him to come to Rome. Hence his best works remain in Florence.

One of the artists who united in himself most of the qualities for which the Florentine school is celebrated was Andrea Vannuchi (born in Florence 1488, died 1530), better known by the name of Andrea del Sarto, who, although his first instructor Gianetto Barite knew but little, afterwards formed his taste and style by the study of the cartoons of Leonardo da Vinci and Michael Angelo. Many of his larger paintings are in Florence and are highly celebrated. In the year 1518, Andrea went at the invitation of king Francis I. to Paris, where he was very well received; but he acted ungratefully towards the king and left him after a short time. In order to appease him the artist afterwards painted two exceedingly fine large pictures, one of which was *the Sacrifice of Abraham.* The king, however, was too much incensed to receive the pictures, which afterwards passed through various hands, and of which the one above mentioned is now in the gallery at Dresden. A picture by Raphael, representing Leo X. and two cardinals, was copied by Andrea with such skill and fidelity, that Giulio Romano, who had himself wrought on the original under Raphael's superintendence, mistook the copy for the original. One of the finest works of Andrea del Sarto

is the Madonna for the church of the Annunciation in Florence. In France there are a *Tobit and the Angel*, two *Holy Families*, and a *Charity*. The last named picture, of which we have given a sketch (*pl.* 17, *fig.* 7), was painted on wood; but as the worms had got into it, it was transferred from the wood to canvas, a rather difficult process, but which has frequently been attempted in recent times with good success. Another very fine picture by this master is *the Descent from the Cross*, or *the Entombment of Christ* (*pl.* 16, *fig.* 8), which was formerly in the Pitti palace, but is likewise now in Paris. His *Last Supper*, in the refectory of St. Salvi, saved Florence in the year 1529 from destruction by fire; for at the taking of the city, the soldiers, who had already destroyed the church, were only restrained from setting fire to the monastery by the beauty of the picture. Andrea died of the plague in 1530. The most distinguished of his pupils were Francesco Saviati and Giorgio Vasari, although these afterwards worked more after Michael Angelo. We must here mention also Franciabigi and Domenico Puligo, the latter of whom acquired Andrea's beautiful coloring and dusky tone, but was unable to master his correct drawing and certainty of outline.

Michael Angelo Buonarotti, of whom we must now speak particularly, was born in 1474 in the town of Caprese, and manifested at an early age a strong inclination for the arts of design; he was accordingly placed under the instructions of Domenico Ghirlandaio, after which the Duke Lorenzo de' Medici took him into the school of design founded by himself, where he enjoyed the instructions of Bertoldo the sculptor. Here he greatly distinguished himself and wrought both as painter and sculptor; in sculpture especially he executed several admirable works in Bologna and in Florence, of which his beautiful statue of David (in 1504) in the latter place deserves particular mention. After Michael Angelo had given considerable proofs of his talent as a painter, he was commissioned along with Leonardo da Vinci to decorate the senate-hall with historical paintings; and the cartoon which he then sketched, representing a scene from the Pisan War, was perhaps his best performance. Unhappily it was destroyed at the taking of Florence along with a number of other treasures of art. Julius II., through the many proofs of favor he bestowed on Michael Angelo, was the cause of much ill will towards the artist. This feeling produced an attempt to withdraw him from sculpture which made him celebrated, and in consequence he received the commission to paint the vaulted ceiling of the Sixtine chapel; he executed the task very unwillingly, completing the painting in the incredibly short space of twenty months, after which he returned to sculpture. Under Pope Clement VII. Michael Angelo began the cartoon for *the Last Judgment* in the Sixtine chapel; he commenced painting it under Paul III. in the year 1534, and in seven years it was finished. This, the grandest work of art of its time, soon gave offence by the excessive nakedness of its figures, and Paul IV. was inclined to have it entirely effaced from the wall, though he afterwards contented himself with letting Daniel of Volterra paint drapery over the offensive places, a task which procured for the artist the nickname of the "Breeches-maker"

(*Brachettone*). The *Last Judgment* attracted immense attention, and artists studied it with such zeal that they neglected to observe the medium which Michael Angelo had himself already deserted, so that this painting originated a peculiar but by no means lovely style of art, which was now adopted by many. We cannot here enter into a more particular description of the picture itself, but must merely remark that with all its grandeur and its many beauties, there is in it much that is defective in composition and exaggerated in execution. The last considerable works in painting which Michael Angelo undertook were two large pictures in the Pauline chapel, one representing *the Conversion of St. Paul*, the other *the Crucifixion of St. Peter*. Of his achievements as a sculptor we have already spoken, p. 52; and his architectural performances we have reviewed in another division of this work. He died in the year 1564.

Shortly after the time of Michael Angelo the art declined considerably, partly through an excessive and injudicious imitation of the manner of this master, and partly through the heedlessness of the artists themselves, who preferred doing a great deal to doing it well. The influence which Michael Angelo exerted on the practice of art was not confined to Italy alone, but spread over the whole of the artistic world of that period; for when art was in its most flourishing condition, at the beginning of the 16th century, most foreign artists went for a time to Italy to study both the antique and the works of the great masters, and thus the new manner which had become so popular, of giving an excessive prominence to anatomy, was transplanted to Spain, Portugal, France, and even to Germany.

Immediately after Michael Angelo, the following masters, who were in part, at least indirectly, his pupils, rose to distinction, viz. Rosso di Rossi, by whom there are several very beautiful paintings, in his fiery but clever manner, in the church of Florence, although most of his finest works in France (in Fontainebleau) have totally perished. Daniele Ricciarelli, also called Daniele da Volterra, where he was born in 1509, studied under Baldassare Peruzzi, and then worked for Perino del Vaga, until he gave himself wholly to the study of Michael Angelo. His best picture, which is also reckoned among the four best pictures in Rome (comp. p. 84), is the *Descent from the Cross* in the church of the Trinità de' Monti. It is supposed that this picture was planned and drawn by Michael Angelo, who showed great kindness to Daniel of Volterra. Daniel engaged also in sculpture, and made a great many plaster casts of Michael Angelo's statues.

Giorgio Vasari, born at Arezzo in 1512, was a pupil of Andrea del Sarto and of Michael Angelo. In addition to his merits as a painter, he has acquired fame in the literary world, by his Lives of the Painters, Sculptors, and Architects from Cimabue to his own times, which, besides admirable notices respecting the history of art, contain so many useful precepts for the practice of art in general, that they must form an indispensable study for every young artist. His work has been translated into English by Mrs. Foster, and is published in Bohn's Standard Library. He executed many large and fine paintings in Florence, Rome, and Arezzo, and founded a

school of art of his own. One of his pupils was Francesco di Rossi, also called Salviati, who had previously studied under Andrea del Sarto, and who almost surpassed his master.

About this time a new revolution occurred in the Florentine school. Grace and coloring, and above all that charming harmony which attracts and satisfies the eye, had been kept by Michael Angelo and most of his followers completely subordinate; but at length these more sensual advantages of other schools, especially of that of Lombardy, had the effect of producing a reform in Tuscany also, the glory of which was reserved for Ludovico Cardi and Gregorio Pagani.

Ludovico Cardi, called also Cigoli after his birthplace, was born in 1559 and died in 1603. He was a pupil of Allori, but soon united himself to Gregorio Pagani in common studies, especially of the works of Barozzio and Correggio. Cardi had laid a good foundation in anatomy, and Pagani in coloring. The anatomical figure often met with in the painter's studio is a production of Cigoli's, who first made it of colored wax. The most celebrated among his numerous works is the *Martyrdom of St. Stephen*, which he painted in 1587 for the Monastery of Montedomini. An oil-painting in the Paris Museum, an *Ecce homo*, of which we have given a sketch in *pl.* 15, *fig.* 3, is also highly esteemed. There are commonly remarked in the works of Cigoli a vigorous style and a beautiful gradation of coloring; he knew how to give variety to the tints in Correggio's manner, and showed great industry both in planning and in execution. He likewise applied himself to architecture and perspective, as is proved by his work on the latter subject. In Rome too, although he there experienced much ill will, Cigoli found work in the Vatican, and at last had the Maltese order of knighthood conferred upon him.

The succeeding time produced among the pupils of Cigoli and Pagani many capital painters, who, however, gradually transferred to the Florentine a great deal of the characteristic peculiarity of the Venetian school, as is shown for instance in the works of Passignano, whose figures in their attitudes remind us of Tintoretto, while the draperies reproduce Paul Veronese. Jacob Chimenti (better known by the name of Jacopo di Empoli) took Andrea del Sarto for his model. Comodi, a pupil of Cigoli, copied the pictures of Correggio and other Venetians with such truth and spirit, that many of these copies are preserved as originals of that master in the galleries of Italy. It was at this time that the Salimbeni (Arcangiolo and Ventura) and Raphael and Michael Angelo distinguished themselves. A decided reputation was likewise gained by their contemporary Francesco Rustici, called Rustichino; he was exceedingly skilful in the management of chiaroscuro, and in some pictures which he painted the illumination of wax candles is imitated with surprising fidelity. In the gallery at Florence there is seen a very beautiful *Dying Magdalen* by him (*pl.* 17, *fig.* 5), and in the Borghese Gallery in Rome a *St. Sebastian*. Christoforo Allori, who was born in Florence in 1577, also took the works of Cigoli and Pagani for his models, and his picture of *Judith with the head of Holofernes* was highly prized. He here portrayed his mistress Mazza Firra, and the head

of Holofernes bore the features of the painter himself; by which he meant to intimate that love had deprived him of his senses. His mistress's mother also appears in the picture as an attendant. He gained great celebrity by his portraits and his copies after Correggio's Magdalen, which were frequently taken for originals. Matteo Roselli was preëminently a pupil of Pagani, whose works, when the latter died in 1605, he also completed. His fresco-paintings are famous; and one of them was so beautiful, that when in 1773 the chapel whose vaulted ceiling it adorned was to be rebuilt, the whole vault on the 13th of April was removed by Paoletti the architect to another place without the slightest rent. Francesco Furini, a pupil of Roselli, perfected himself further in Rome and Venice. He afterwards entered the clerical order and became a curate. His profession, however, did not prevent him from zealously studying the female form and portraying it with a grace and truth of coloring worthy of the school of Albano. One of his best pictures is that of *Andromeda chained to the rock and awaiting the approach of the sea-monster*, in the Florentine Museum, a picture of which we have given a sketch (*pl.* 18, *fig.* 4). Yet Furini also painted some altar-pieces and frescoes in the serious style. The works of Carlo Dolce, who likewise belongs to this time and to this school, bear the character indicated by his name. They consist mostly of half figures of Madonnas, and saints of both sexes, which are full of a charming devotion and softness. Their execution is masterly. Carlo Dolce never painted profane subjects and only a few large compositions.

Pietro Berettini, better known by the name of Peter of Cortona, was born in the year 1596, and received his first instructions in art from different masters; by them however he was soon left to his own resources, and he formed himself on the works of Raphael, Michael Angelo, and other great painters. He soon had the good fortune to receive some considerable commissions, in particular one to paint the ceiling of a grand hall in the Palazzo alle quattro Fontane, which Pope Urban VII. had purchased for his family, a task of great importance, which the young artist executed with equal good fortune and ability. The compositions display a wonderful ease, graceful drawing, a light and brilliant coloring, and an admirable distribution of light and shade. In the year 1637, he was summoned to Florence, to paint some chambers in the Pitti palace, for which the ideas were given to him by a scholar, the younger Michael Angelo Buonarotti. Pietro, to express his gratitude for the same, presented Angelo with the whole of the cartoons for these paintings and the portraits of the eight most beautiful young girls of Florence, which he had painted in the palace in medallions containing two each. Two of these medallions, one representing the Muses *Polyhymnia* and *Erato*, and the other *Euterpe* and *Urania*, are copied *pl.* 16, *figs.* 9 and 10. The fifth of the chambers committed to him he did not complete; for having been insulted by a nobleman, he returned to Rome. This chamber and the other works left uncompleted by Pietro were finished by his pupil Ciro Ferri. In Rome Peter of Cortona painted the cupola and the vault of the church of the Padri dell' Oratorio and the Pamfili gallery, where he portrayed the deeds of Æneas. Pope

Alexander VII. knighted him. This artist also distinguished himself as an architect. He died in 1669.

Among the later imitators who adopted the light and graceful manner of Pietro Berettini but few have attained to great celebrity: the most notable of them is Luca Giordano, of whom we shall have occasion to speak further on. Ciro Ferri and Francesco Romanelli were able to imitate their master so closely that even connoisseurs ascribed their productions to Pietro da Cortona.

c. The Venetian School. In the different states of the Venetian territory we find monuments of painting and mosaic which are undeniably of Grecian origin, but which at the same time go to show that in this part of Italy the arts were never wholly lost. The mosaics in the church of St. Mark were begun in the year 1070, and were solemnly dedicated in 1084; they are the oldest monuments of art in Venice. Abbot Jacob painted in 1180 the figure of the Savior, and about the year 1200 one Theophilus from Constantinople had a school of painting in Venice. All these works and others equally old are wholly in the coarse and spiritless taste which characterizes the Greek works of art of that period. The history of Venetian painting may properly begin with Guariento, who lived about 1360; for he already departed to some extent from the Greek style, as did likewise his contemporary Nicoletto Semitecolo, who lived in 1367, and Sebastian of Murano, pictures by whom are still extant, and who was living at the beginning of the 15th century.

There are in Venice several paintings by Luigi Vivarino of the year 1414, among them a *Christ bearing his Cross* and a *St. Jerome and the Lion*, and, which is remarkable, they are painted on canvas, which did not become usual till the time of Titian. Our next example of artistic talent is a *German* master, Johannes da Alemannia he calls himself on his pictures, who in 1445 painted in the church of San Giorgio Maggiore a *St. Stephen* and *St. Sebastian*. It cannot be a work of Johannes van Eyck, because, although several of his pictures came to Italy, he was dead in 1441. At this time we find in Venice three classes of painters: those who adhered strictly to the ancient traditional practice of the art, those who ventured to depart from the original coldness and stiffness, and the school of Giorgione. At the head of the first class stands Vittorio Carpaccio, who distinguished himself by his knowledge of perspective, which was then sadly neglected. The chief of the second class is Giovanni Bellini (born 1424, died 1514), who made considerable advances in the direction of correct taste, although he simply imitated nature. He devoted his attention principally to coloring and harmony. There are good pictures by this master in various galleries; his elder brother, Gentile Bellini, was likewise a good painter, but did not equal Giovanni. The third class, namely of painters who at once renounced the old stiff manner, begins with Marco Baisati; he painted till 1520, and his finest works are in the different churches of Venice.

The flourishing period of Venetian painting begins with Andrea Mantegna (born 1431, died 1505). He early distinguished himself by his great

talents, and painted the altar-piece of the church of St. Sophia in Padua, his native city, when scarcely seventeen years old. His finest picture is the *Triumph of Julius Cæsar*, for which, in order that it might be worthily displayed, Duke Ludovico Gonzaga caused a separate building to be erected in Mantua. In the year 1630 the picture was lost with several valuable articles, and is now in England, in the royal palace at Hampton Court. Mantegna was rewarded with the rank of knighthood, and then went to Rome, on the invitation of Innocent VIII., where he painted in the Belvedere. He married the sister of Giovanni Bellini, and this near connexion with the latter had a favorable effect on Mantegna's hitherto rather dry manner.

Giorgio Barbarelli, known by the name of Giorgione of Castelfranco, was born in 1477. He was a pupil of Giovanni Bellini, and distinguished himself so greatly by his talents, that his master, becoming jealous of him, drove him from his school; whereupon he labored to improve himself by independent study, and painted some altar-pieces, but chiefly frescoes on the façades of houses. Giorgione loved the clear and bright in pictures; his figures are full and round, and his drawing is correct. It being urged that sculpture is superior to painting, inasmuch as it allows the object to be viewed from all sides, he painted a celebrated picture for the purpose of showing that painting can do more, since it can enable us to behold its object on several sides from the same point of view. He painted a man with his back to the spectator and his front reflected in a fountain; his right profile was reflected in the shield of a suit of armor placed on one side, and his left profile in a mirror on the other side. Giorgione painted several excellent portraits besides larger pictures, which, however, are rare. He died early (in 1511); nevertheless he was the proper founder of the Venetian school.

Tiziano Vecellio, one of the three great masters of the art of painting, was born at Pieve, in 1477, the same year as Giorgione, and enjoyed in youth the benefit of a classical education; but as his talents for painting soon manifested themselves, he was placed in his tenth year under Giovanni Bellini. With him, however, he did not long continue, but soon proceeded to improve himself by independent study and imitating the works of Giorgione; but he cannot on this account be called his pupil, since he painted along with Giorgione the frescoes on the German Bazar in Venice. In Padua Titian painted in company with Campagnola and others the church of San Antonio; and after his return to Venice, he completed the works he had begun, one of which represented the Emperor Frederick I. at the feet of Pope Alexander III; into this picture he introduced many portraits from nature, a very favorite practice at that time, but which produced many anachronisms in costume. In Ferrara Titian executed several works for Duke Alfonso I; and to this period of his life belongs *the Tribute-Penny*, a picture of which innumerable copies have been spread abroad in engravings and lithographs, and which forms one of the greatest treasures of the Dresden gallery. He painted the emperor Charles V. in Venice three several times, in 1530, 1532, and 1537; in 1547 and 1550 he painted him

in Augsburg, and the emperor made him a knight and count palatine. After his return to Venice, Titian painted the admirable picture of *Peter the Martyr*, which was carried off with several of Titian's paintings to France, but was afterwards restored. Among these pictures was also the *Christ crowned with Thorns* from Milan (*pl.* 18, *fig.* 3), which was taken from the church of Maria delle Grazie and is now in the Florence Museum. Titian bestowed great pains on the execution of the landscapes in which he placed his figures, and indeed it was he who prepared the way for the great landscape painters who came after him. But his greatest eminence was in historical portraits and in characteristic heads generally. Titian studied the antique with great zeal, and we meet in several of his works with reminiscences of the Laocoon and of some ancient reliefs in the church of Maria dei Miracoli, which Rossi has declared to be works of Phidias himself. It is also well known that Titian afterwards became the great exemplar for the portraying of children, and that Poussin, the so-called Fiamingo, Algardi, and all who have rendered themselves eminent in this line, have made him their study, in order to master that expression of naive innocence and unassuming truth which constitutes its charm. Titian painted flesh with great skill. The gradation of his tints is so admirable that they can be distinguished only by comparing one with the other with the closest attention. Each one appears as flesh in itself, and the endless variety of all of them is subjected to the unity of one dominant tone. This is most conspicuous in his famous *Venus* in Florence, which, when the spectator stands close to it, seems to be painted with a single color, so that neither light nor shadow, so to speak, is discerned in it; but the further one recedes towards the proper point of view, the more everything appears rounded and seems to stand out from the level surface. Titian to the last remained like himself and was always great; although in his latest pictures, in place of that diluting and blending of the tints, we find the parts boldly delineated with a firm and masterly pencil. Titian died in the year 1576, of the plague, when 99 years old.

Among the pupils of Titian and Giorgione we will mention first Sebastiano Veneziano, who afterwards received the office of attaching the leaden seals (*piombe*) to the papal bulls, a very profitable sinecure, from which he received the name of Sebastiano del Piombo. He was born in the year 1584, and was at first a pupil of Bellini; but he soon left the rather dry manner of that master, and took as his models Giorgione and Titian. He painted historical pieces and portraits with great success. In Rome he painted along with Raphael in the Farnesina; and Michael Angelo, who wished to advance him, praised his works beyond measure, and made for him compositions, drawings, and even the cartoons for his pictures, so that after Raphael's death, Sebastian came to be regarded as the first painter. Giacomo Palma Vecchio (Palma the Elder) was also at first a pupil of Bellini, but afterwards received instruction from Giorgione, and lastly from Titian. In his pictures we find one after another all the peculiarities of these masters repeated: on which account Zanetti said that the beauties of his pictures were the daughters of the beauties of the works of other artists

Venice has a profusion of paintings by Palma Vecchio; and in the German galleries, especially in Venice and Dresden, there is no lack of them, for he was very industrious. Paris Bordone, of a noble family in Trevizi, was born in the year 1500, and died in 1570. At an early age he came to Titian and resided under his roof, where he also studied the works of Giorgione. Paris Bordone painted a great deal and very beautifully; his finest production adorns the Academy of St. Mark. It represents an aged gondolier presenting to the Doge and senate a ring which he had received from St. Mark during the night of a dreadful storm.

Licinio Pordenone was a pupil of Titian and his most zealous rival; he was born in 1484, and died in 1540 most probably of poison. Between the pupil and master there existed great jealousy, which on the part of Pordenone was exhibited in a not very noble form, it being his constant endeavor to paint along with his master and to lower him in public estimation. It may be that occasionally by a happy effect of coloring or bold sweep of the pencil he was able to surpass Titian; but in the art of breathing a soul into his figures and causing the flesh to seem instinct with life he could never equal him. In Titian it is more nature than manner, in Pordenone the contrary is too often the case. His pictures are to be found in Venice, Mantua, and Vicenza, and also in Genoa and Ferrara, where he directed the tapestry manufactory and furnished the cartoons. Various galleries likewise possess pictures by him.

We have some excellent works by Francesa Vecellio the brother, and Marco Vecellio the nephew of Titian, both of whom were his pupils; but the former afterwards applied himself to mercantile pursuits, being urged to do so, it is said, by Titian from feelings of jealousy; Marco accompanied his uncle to Germany. Titian's son Orazio, to judge by the way in which he began, would have performed admirable things, had not his excesses led him to an early death. Marco's son, Tizianello, shows in his works a decline of the Titian school; for he lacks both grace in designing and vigor in handling the pencil.

Giacomo Robusti, called *il Tintoretto*, because he was the son of a cloth dyer in Venice, was born in 1512, and was placed at a very early age under the instructions of Titian; the latter, however, perceiving the powerful talents of the youth, and having no desire to raise up a rival to himself, soon dismissed him. The young man was not to be discouraged, and he determined to form by his own exertions a style combining the drawing of Michael Angelo with the coloring of Titian. He accordingly procured for himself plaster casts of antique statues and of works of Michael Angelo, and industriously set himself to studying them. He also modelled for himself small figures, which he clothed and studied the effects of light and shade displayed upon them by candle light; and thus he formed his manner, which is so distinguished for the boldness of its chiaroscuros. The fire of his genius urged him on to the greatest rapidity in working, in consequence of which he received the cognomen of *il Furioso*. But this haste unfortunately was detrimental to correctness, and his vehemence often carried him beyond the bounds of truth. In the beginning of his most flourishing

period, Tintoretto painted two enormous pictures in the church of Maria dell' Orto; in one of which, the *Last Judgment*, his study of Michael Angelo is perfectly obvious. The composition is very fine; but some of the foreshortenings are too daring, and in many of the figures the centre of gravity is unsupported. The other picture was the *Worship of the Golden Calf;* and in both pictures, which are 50 feet in height by a comparatively narrow width, the master succeeded in suitably filling out the space. In the same church, in the chapel of St. Agnes, is a picture by Tintoretto which Pietro da Cortona valued so highly that he copied it for his private study. This picture and a *St. Mark delivering a Slave from the Rack* are regarded as works worthy of a Titian. Another famous picture is that of the *Adultress before Christ*, of which we have given a sketch (*pl.* 17, *fig.* 4), and in which we cannot but admire the graceful grouping of the figures, although here too some bold attitudes are to be found, witness the two figures to the right and left in the foreground. That of the adulteress is rather colossal. The rapidity with which Tintoretto worked is evinced by the following anecdote. The first painters were invited to a trial of skill in furnishing designs for a ceiling-painting, the execution of which was promised to him who produced the best. While other painters were making their sketches and drawings, Tintoretto painted his picture out and out, and on the day of adjudication caused it to be secretly fixed in its destined place; so that when the prize was awarded him, the work was already done. In consequence of his great fertility, almost all good galleries possess pictures from his hand. His son Domenico and his sister Maria have likewise a good reputation in the pictorial art.

Paolo Cagliari, called from his birthplace Paolo Veronese, was born in 1532. His works soon became so distinguished in point of coloring as to be mentioned with applause along with those of Titian, Palma Vecchio, and Tintoretto. Titian honored the young artist highly, and when he was to select the artists to paint St. Mark's Library, his first choice fell on Paul Veronese. Paul afterwards went for a while to Rome, in order to impress upon his mind the beauties of art collected there. It is difficult to say which of his numerous works is the best; still four great paintings representing "Suppers" doubtless merit the preference. One of these, in the refectory of San Giorgio Maggiore, is about 40 feet long and represents the *Marriage at Cana.* The picture exhibits as many as 120 beautiful figures, many of which are portraits of contemporaries; these, collected as they are from far and near, are very curiously grouped. A party of musicians are likenesses of painters: Titian is playing the double bass, Paul Veronese the violoncello, Tintoretto the viol di gamba, &c. The other Suppers are the *Feast of Simon and the Penitent Magdalen* (twice) (Matt. xxvi. 7); and the *Feast of Levi* (Luke v. 29). Paul painted several other feasts; but he also knew how to handle serious and sacred subjects with equal skill. Great fertility of imagination and great facility of execution joined to a good knowledge of the technics of his art, were the distinguishing qualities of this artist; on which account he often allowed himself in his pictures to be led away into episodes which, together with the introduction of costumes from different ages in one

and the same painting, make his works deficient in historical truth. His draperies and architecture are excellent and effective; and his colors, boldly laid on, are fresh and bright, with clear and transparent reflected lights. He died in 1582.

But from this point the Venetian school, which had now reached the pinnacle of its greatness, began to decline. Giacomo Palma the Younger (b. 1544, d. 1628) was the first to enter upon the downward path; for although he took Titian and Tintoretto, Michael Angelo and Caldara for his models, he worked far too hurriedly to attain to any degree of excellence. The number of his productions is excessively great. His example was followed by a long series of artists, none of whose names enjoy much celebrity. The Venetian painters, in the most flourishing period of their school, had created for it a certain national character; and although each of its greatest masters, Titian, Bassano, Tintoretto, and Paul Veronese, had a style peculiar to himself, it was derived in each case from nature, and their combination formed the national style, which was also adhered to by their pupils, although in their hands it underwent a gradual deterioration. The Venetian school, however, notwithstanding the constancy with which it had at first opposed itself to every foreign influence and even to the great inundation of Buonarottists, was at last forced to submit, and, mingling with these, to bow to its utter fall. Of the late masters of the Venetian school the following only are deserving of mention. Giovanni Battista Piazetta (b. 1682, d. 1754) studied diligently the works of the Caracci and of Guercino, and distinguished himself by his admirable handling of chiaroscuro; for by means of models of his figures he placed nature before his eyes and investigated the effects of light and shade: hence too he was able to manage the reflected lights exceedingly well. His coloring is pale and chalky, and his draperies heavy, which last defect doubtless originated in his modelled figures, where the folds of the small garments on account of their want of amplitude could never be made to fall naturally. His best picture is the *Beheading of John the Baptist*, in the church of St. Anthony in Padua. Giovanni Battista Tiepolo (b. 1693, d. 1769) manifested remarkable talents in his youth and formed his manner on the works of Paul Veronese. He made long journeys even to Germany, where he painted, especially in Würtzburg. We desiderate in his pictures a rather more correct drawing. The *Banquet of Antony and Cleopatra*, in Dresden, with figures of the size of life, is a splendid picture. Tiepolo also executed various engravings, apparently on tin.

We must here mention one other master, although he does not properly belong to the Venetian school, since all that he was he became through his own exertions, and he preserved his individuality to the last. We allude to Antonio Allegri, called Antonio da Correggio, born 1499. His father was named Pellegrino, and he received his first instructions from his uncle, Lorenzo Allegri; but as Lorenzo was no artist, these instructions were of little account. Hence Correggio was soon reduced to the necessity of depending upon himself, and his genius was lofty enough to enable him to surmount all opposing obstacles. Accordingly we never meet in his

works, which were constantly advancing nearer to perfection, with anything borrowed from another hand. Correggio was never in Rome; and hence it is impossible that he should, as many have asserted, have formed himself on the study of Raphael; besides, it would be no difficult matter to show a complete contrast between the manners of these two masters. Raphael was, so to speak, an enemy to foreshortenings, Correggio was very fond of them, as being so favorable to graceful turns; Raphael sacrificed everything to expression, Correggio to harmony; Raphael sought beauty in a certain nobleness of form, Correggio in a luxurious wantonness; Raphael made use of a natural, open light, Correggio always produced it artificially; and this contrast might be extended even to the details of their works. The first pictures of Correggio are to be found in his birth-place; yet the originals have been removed, some of them at the command of the lords of Correggio, and others in some inexplicable manner, so that copies are now found in their stead. One of his earliest productions is the *St. Cecilia* in the Borghese gallery. This picture reminds us strongly of Mantegna; yet the peculiar illumination which proceeds from an angelic glory and spreads almost imperceptibly over the whole picture, leaves no room to doubt its belonging to Correggio, notwithstanding that certain hardnesses are to be found in it. A work of Correggio's of the year 1520 exists in a convent of Parma, but it is so little accessible to visitors, that we had no account of it till quite lately. Seroux d'Agincourt was the first to publish a drawing of it (in his "Painting," pl. 202). It was about this time that our master began the cupola of St. John's church, which he finished in the year 1524. It represents the *Ascension of the Saviour*, together with the apostles, Mary, &c., and was so beautiful that the superintendents of the cathedral as early as 1522 contracted with Correggio, at the price of a thousand sequins, for the painting of a picture for the cupola, which, however, was not begun till 1526. This sum as well as other prices which were paid Correggio for his works, and which for that time were very considerable, furnish the best refutation of the statement of the artist's poverty; the story of his having expired under the burden when paid a fee of sixty sequins in copper money is likewise fabulous, it having been proved that the fee was paid in gold and that Correggio lived for several years afterwards. The cupola of the cathedral represents the *Assumption of the Virgin;* and Mengs says with justice that no more beautiful cupola has been painted either before or since. While this work was going on Correggio painted his *St. Jerome* and his famous *Night.* For the former he received 400 lire; the King of Portugal afterwards offered 40,000 ducats, and Frederick the Great 25,000 sequins for it. There are many who prefer this picture to the works of Raphael. The *Night*, *i. e.* of the Savior's birth, was ordered by Alberto Pratonieri, and the price of it was 208 lire (47½ sequins). The picture was finished in 1530 and set up in the church of St. Prosperus; in 1640 it was removed to the gallery at Modena, whence again it was taken to Dresden, and only a copy on canvas by Nogari remained in Modena. There are many good old copies of this famous picture. Among other things Correggio painted about this time for the Duke of Mantua a *Leda*

and a *Venus*, to which afterwards was added an *Io.* These pictures went through many strange adventures, until at length they fell into the hands of Queen Christina of Sweden, who had them made into window-shutters, but afterwards gave them to Bourdon the painter. Thus they came to France, where they remained till Philippe Egalité (father of king Louis Philippe) sold them to England, where from puritanical motives they were cut up and the head of Io burnt. The remaining pieces came into the possession of Charles Coypel, after whose death they were sold at auction and were purchased at a high price by the king of Prussia. The Leda and Venus were restored by Lyen the painter. Both are now in the Prussian gallery. The Io was bought by M. de Calabre, and Collins restored it very beautifully. There are several other fine paintings of Correggio in the Dresden gallery: among them is the picture known by the name of *St. George*, which was originally painted for the brotherhood of St. Peter in Modena; the *St. Sebastian;* the picture of *Dr. Francesco Grillenzoni;* and lastly the famous *Magdalen*, which was stolen by Wogaz in 1788, but was afterwards recovered. This picture, which was painted by way of exception on a plate of copper, is so beautiful, that it has been many times copied, and among others by Titian himself. In Spain too there are several excellent paintings by Correggio; and the great number of his works, all of which we cannot possibly enumerate here, proves how indefatigably industrious this artist must have been, for he lived to be only forty years old, and never, even in his great cupola pieces, made use of an assistant. The principal qualities by which Correggio is distinguished are grace, harmony, and the management of the brush. Correggio was unsurpassed in his knowledge of chiaroscuro, and it is evident that this branch of his art he must constantly have studied from full-rounded figures; in aerial perspective he seems to have taken Leonardo da Vinci for his model; but in everything nature was the chief instructor of this master, who well knew how to profit by her precepts. Correggio's pupils were not numerous, and none of them attained to any great celebrity.

d. The Bolognese, Lombard, and Neapolitan Schools. Bologna is one of the oldest and most famous cities in Italy; and ever since Bishop Petronius founded its renowned university under Theodosius the Younger in the year 432, the arts and sciences have constantly been cultivated there. The oldest paintings it possesses date from the year 1120 and are marked P. P. F. Guido da Bologna painted at the close of the same century, in 1180; Ventura, in 1217 and 1220; and the painter Ursone flourished in 1240. Pictures by all of them are still preserved in Bologna in the Malvezzi palace. Vitale, a pupil of Giotto, painted about the year 1320, and there are pictures by him and by his fellow pupil Lorenzo da Bologna in several places in the city; but the greater part of them have been whitewashed over or have perished in some other manner. Marco Zeppo was the instructor of Francesco Raibolini, known by the name of Francesco Francia. He was born in 1450, and may be regarded as the head of the Bolognese school; for at the time when Vanucchi flourished in Rome, Leonardo da Vinci in Florence, and the Bellinis in Venice, he was the first artist in Bologna, and his works

in the Chiesa alla Misericordia and the San Giorgio Maggiore place him on a level with those artists. Although his rich compositions are to a certain degree lacking in fire, yet his drawing is correct and his coloring better than that of Perugino. Francia was an intimate friend of Raphael, who sent him his portrait. He formed a considerable school, from which proceeded, among others, Timoteo Vite and Marc Antonio Raimondi, who afterwards became a pupil of Raphael.

Besides the school of Francia, Innocenzo de Imola formed a school of painting. Here Francesco Primaticcio, born in 1490, acquired the principles of his art; although his knowledge was chiefly obtained through Giulio Romano, to whose pupils he belonged. He executed many works in Mantua, in the Palazzo del Te. Francis I. in 1531 invited him to France, where he met with Rosso and remained nine years; the king then sent him to Rome to purchase antiques, and with Vignola's assistance to take plaster-casts of several ancient statues and reliefs, a mission which he undertook with benefit to himself; and it was not till Rosso's death in 1541 that he was recalled, to complete that artist's unfinished works. Under Francis II. he was made superintendent in chief of the royal palaces; and, as he was likewise an architect, he designed the plan of the Castle of Meudon. Primaticcio had a great deal of invention and colored with taste; yet his many and great works left him too little time for the study of nature, and hence we often perceive in him a mannerism. Among his pupils, Nicolo dell' Abbate and Alberto Fontana rose to eminence. Among the works of Nicolo great praise is bestowed on the gallery in Fontainebleau, unfortunately pulled down in 1738, in which the exploits of Ulysses were portrayed after the designs of Primaticcio. They have been engraved by Theodore Van Tulden and also by Kilian.

We have already remarked on several occasions, that in the beginning of the 16th century the influence of Michael Angelo's manner was very perceptible not only in the rest of Italy but also in Bologna, since most of the artists not only sought to make this manner their own, but fancied they could improve upon it by their experiments; and thus gradually arose a mode of painting which not only wanted firmness but was often erroneous in drawing, while it was feeble and wishy-washy in coloring, and without even a semblance of truth to nature. Unhappily this corrupt taste had spread, to the great detriment of true art, throughout Italy, and there were but few artists, and those chiefly of the Bolognese school, who were able to stem the torrent with much success. But at length arose the Caraccis, who earned for themselves the glory of imparting new life and vigor to art.

Ludovico Caracci (b. 1555, d. 1619) was the son of a butcher; and as he manifested a great inclination for painting, he was placed under the instructions of Prospero Fontana. His quiet and contemplative disposition, however, caused him to be misunderstood; and the fiery Fontana as well as Tintoretto pronounced him destitute of talent. Upon this the young man withdrew himself into retirement; he remained a while with Passignano in Florence; then studied the masterpieces of Primaticcio, Andrea del Sarto, Correggio, Giulio Romano, Paolo Veronese, and Titian; and at

length, furnished with profound artistic knowledge, he began his glorious career in Bologna. He had two cousins, Agostino (b. 1557, d. 1602) and Annibale (b. 1560, d. 1609), who likewise devoted themselves to painting, the former studying with Fontana, the latter with Ludovico. The two brothers lived in a constant state of alienation, and their mutual interests as artists and as men could not induce them to behave in a friendly manner towards each other. Agostino was noble and talented, and pursued all his scientific studies with much success; but Annibale, whom his father had destined to be a tailor, and who scarcely knew how to read and write, constantly ridiculed his brother's learning, as the means of dissipating his powers. Agostino in consequence, who saw with what gigantic strides his brother was advanced in the art of painting, determined to renounce it, and applied himself successfully to copperplate engraving. About the same time Annibale exhibited his first works, consisting of two altar-pieces, a *Crucifixion* and a *Baptism of Christ;* but as these were simply, nobly, and naturally executed, they were attacked on all sides, so that the painter's only present reward was the hope of seeing the right ultimately triumph. Ludovico and Annibale pursued with the greatest ardor the path they had struck out, and Agostino likewise again took up painting. About the year 1580 Annibale went to Parma, and then to Venice; and after his return the three Caraccis painted together several friezes in the Fava palace, representing *the Exploits of Jason*, and Ludovico alone painted in a hall *the History of Æneas.*

In spite of all opposition the three artists quietly pursued the course which they had decided to be the only correct one, and at length they founded a school of painting in which the study of the nude figure and of the antique was pursued with great zeal, and where Agostino lectured on the theoretical branches, architecture, perspective, anatomy, &c. From this time forward the reputation of the Caraccis kept spreading more and more. Ludovico had already distinguished himself by several large works, Agostino shone as an engraver, and Annibale by his paintings, which excited universal admiration. The Caraccis, after having studied the works of the greatest masters, formed a manner of their own, in which the character of one or the other master served as a pattern, and they always chose with great judgment that which was most suitable. Accordingly when the nature of the subject required it, they produced by their mode of treatment a mixture of the styles of Primaticcio, Tintoretto, Tibaldi, &c.

In the convent of the Carthusians in Bologna Agostino painted his admirable work, *the Communion of St. Jerome*, a production which excited universal attention and which is now in Paris. The fame of the skill of the Caraccis now spread more and more, and many commissions were consequently given, not to any one of them but to all of them together. Thus the grand paintings in the Magnani palace are to be regarded as the work of the Caraccis, and chiefly of Ludovico and Agostino. Two ceiling-pieces are here celebrated, one representing *Galathea as the symbol of Water*, painted by Ludovico, and the other *Pluto as the symbol of Fire*, a work of Agostino. We have given a sketch of the former in *pl.* 15, *fig.* 12, and of

the latter in *fig.* 13, which will afford an idea of the manner of these two masters. About this time Annibale began one of his most celebrated paintings, *viz. St. Roque distributing Alms*, which is now in Dresden, and also the beautiful picture of *Mary, the Magdalen, and St. Francis of Assisi by the body of Christ*, of which a sketch is given in *fig.* 7. Another picture, which adorns the Paris Museum, and is copied in *pl.* 16, *fig.* 7, represents the Madonna with the child Jesus asleep and John the Baptist; it is known by the name of "*Silence*," and is of somewhat later date than the preceding.

Agostino and Annibale next undertook for Cardinal Odoardo Farnese to decorate with paintings the Farnese gallery in Rome. But artistic rivalry between the two brothers, who otherwise were tenderly attached to each other, soon had the effect of disturbing the progress of the work, and Agostino quitted Rome, relinquishing to his brother the honor of completing this great work. In his native country new works awaited him but also new attacks, in consequence of which he fell into a state of dejection and died in the 43d year of his age.

Annibale was occupied eight years in the work of the Farnese gallery: Ludovico also came for a short time to Rome, and one of the naked figures in the medallion of the fable of the Syrinx is painted by his hand. The contemptible recompense which Annibale received on the completion of the work, only 500 scudi instead of 10,000, made him resolve to paint no more; and although he was persuaded to begin in conjunction with Albani a work in the church of St. James of Spain in Rome, the melancholy which had seized him undermined his health and he expired in Rome in the 49th year of his age.

Ludovico, after his return from Rome, had undertaken along with all his pupils a great work, namely to decorate with paintings the portico of San Michele in Bosco, and the subjects were the history of St. Benedict and the legends of St. Cecilia. Many of the largest and finest pictures are by Ludovico himself, and all of them are characterized by an inexhaustible beauty and sublimity; in all of them too we cannot but admire the accurate study of the greatest masters which they manifest and the skill shown in adopting their several manners for those subjects to which they are best suited. The last work of Ludovico was the great vaulted ceiling in the cathedral of Bologna, where he painted the *Annunciation*, giving to the figures of Mary and the Angel a colossal size. Unhappily he committed an error in this picture, which proved the cause of his death. The angel in the act of approaching the Madonna wears a light garment through which the movement of the body is seen. But if we follow out the folds of the drapery, we find that the left foot is where the right ought to be, and *vice versa*. Ludovico did not notice this fault until the scaffolding was taken down and it was too late to correct it; the grief and mortification which he experienced in consequence undermined his health and he died. The error was corrected by Prof. Fancelli in 1830. There were also three other painters of the Caracci family, Paolo, Francesco, and Antonio; but none of them became very celebrated.

The pupils of the Caraccis are innumerable. We find among them

the greatest masters of their time, such as Domenichino, Guido, Albano, and Lanfranco, of whom we shall speak directly. Opposed to the school of the Caraccis was that of the so-called naturalists, which was founded by Michael Angelo Merigi, called, after his birth-place, Caravaggio. He was born in 1569, and manifested a talent for painting in early youth; but he confined himself to a close and slavish imitation of nature without making the least distinction between beauty and ugliness. He went to Vienna and studied Giorgione, after which he removed to Rome, where he gradually came into notice. He here hit upon the idea, while seeking to produce peculiar effects, of painting his studio black and letting the light in from above. He consequently saw all objects with sharply defined lights and shadows, and, by reason of the darkness of the place, without reflexion. His manner in consequence acquired a resemblance to that of Rembrandt, although the latter is far more tasteful and transparent: nevertheless he found very many imitators, and his fame increased from day to day. He received commissions for several altar-pieces, which stirred up many enemies against him; and being of a very quarrelsome disposition and always with a sword at hand, he once killed one of his adversaries, upon which he fled to Naples, and from there to Malta, where he executed his best works. To this period belongs the beautiful picture of the *Entombment of Christ* (*pl.* 15, *fig.* 6), which is now in the Paris Museum. But he also got into disputes in Malta; and as he was about to be cast into prison, he made his escape to Sicily: from there he intended to go to Naples and Rome, but was attacked on the road and so badly wounded that he soon after died (in 1609). Caravaggio adhered in all his works so closely to nature that he copied even her faults; his drawing is deficient in dignity and correctness, indeed in all those advantages which result from a scientific education. Content simply to copy his model, he despised every other means of excellence.

After this brief digression, we return again to the school of the Caraccis, the members of which were busily engaged in striving against the disorders introduced into art by the followers of Caravaggio. The first of these to whom we will call the reader's attention was Giovanni Lanfranco, who was born in Parma in 1580 and received a liberal education; he entered as page into the service of Marchese Scotti, who, perceiving his talent for painting, placed him under the instruction of Agostino Caracci. He here devoted himself chiefly to the study of Correggio's works, in which Agostino encouraged him. Lanfranco followed his master to Rome, and worked with him in the Farnese gallery. From this time the Marchese Sannesi took him into his service; for him Giovanni painted a great deal, and by him the way to great reputation was opened to the artist, for the Marchese brought him to the notice of cardinal Montalto and pope Sixtus, from whom he received many commissions. Lanfranco gained an enviable reputation by his works. His most beautiful production, which he executed wholly in the manner of Correggio, is the cupola in the church of St. Andrea della Valle in Rome, where Domenichino painted the four corners and the tribune. Lanfranco labored four years on this cupola, and the harmony of the whole is admirable,

the distribution of the colors wonderful, and the chiaroscuro and the gradation of the tints are lovely in the extreme. With respect to the celestial glory this cupola is unique in its kind. He did not succeed so well with the cupola of the Jesuits' church in Naples; but this was owing to its construction, it being provided with ribs and having an excessive quantity of gilding. Lanfranco and his followers applied themselves chiefly to the study of the distribution of masses and of movements, after the example of Correggio; yet what they sought was the appearance without the arduous study of the principles of art. The pictures of Lanfranco are distributed in great number through Italy and some through Spain and France. There are also several of them in Vienna and Dresden; but his fresco-paintings are of more value than his pictures in oil.

Guido Reni, born in Bologna 1575, was to have been a musician; but he preferred the study of painting under Calvaert, who directed his attention to Albert Dürer's works. Here Albano and Domenichino were his fellow-pupils; but all three went over to the school of the Caraccis. Guido accompanied Annibale Caracci to Rome, where he soon acquired considerable reputation: his first work was a *Crucifixion of St. Peter*, in the Chiesa delle tre Fontane, a picture in which he endeavored with great success to excel Caravaggio in chiaroscuro. This picture and several others afterwards came to Paris. One of the finest fresco-paintings in Rome is the *Aurora* which Guido painted for Cardinal Borghese, but which during the recent events in Rome has suffered considerable damage. Guido also decorated with his pencil the chapel on Monte Cavallo and one in Sta. Maria Maggiore. He soon afterwards removed to Bologna, where there were already several of his paintings; but he was summoned back to Rome to complete his unfinished works. He then repaired once more to Bologna and afterwards to Naples. But an attempt being there made upon his life, he soon left that city and returned to Bologna, where he finished the chapel of St. Dominic and painted several pictures for the Chiesa de' Mendicanti. This is not the place to enumerate the countless works of Guido, who at length acquired such a facility that he seemed to design with the pencil. There exist also many paintings which go by his name, but which are either copies of his pictures or have been produced by his pupils and merely finished by him. Guido's greatest excellence doubtless consists in the ideal beauty which animates his heads. In his female heads and even in those of youthful males, his study of the ancient group of the Niobids is everywhere visible. The *Madonna* of the Florence Museum (*pl.* 15, *fig.* 10) and the *John the Baptist* of the Paris Museum (*fig.* 11) may serve as specimens. The countenances of his old men and apostles he selected from fine natural ones, because among the models of the antique none of religious inspiration have been preserved. For the representation of the other parts of the body he likewise adhered to nature, without ennobling them by means of the antique; so that the bodies are frequently not in harmony with the beautiful heads. An example of this, and also of what we shall have to say respecting his draperies, is furnished in the *St. Francis* from the Paris Museum (*fig.* 5). Guido's flesh color has too great a tendency

to yellow, but without being disagreeable; his coloring in general is delicious and without offensive prominence. In the folds of his draperies we observe great beauty of form, and sometimes they remind us of Dürer; yet they often want harmony with the remaining whole and with the nature of the material. Notwithstanding the beauty and correctness of his aerial perspective, his linear perspective is often treated in an erroneous manner. Nevertheless, Guido, whose portrait from the Florence Museum is given *pl.* 18, *fig.* 6, is deservedly reckoned among the most distinguished artists. He died in 1642.

Francesco Albano, born in Bologna in 1578, was the third from the school of the Caraccis who labored to uphold it against the exertions of the naturalists. He was a fellow-pupil of Guido; but although they were apparently united by an intimate friendship, a violent jealousy existed between them, which at last broke out into open enmity, so that the one was constantly laboring to eclipse the other. Albano began his public career in Rome, where under Annibale Caracci he executed many of the latter's cartoons in the church of St. James of Spain; but among his most celebrated works is the Verospi gallery. Very celebrated also are his *four Elements*, which he first painted in the Villa Borghese, and afterwards had to repeat several times, each time introducing new ideas. Although Albano's great paintings are excellent, his easel-pictures are preferred, and his representations of *Venus*, *Diana*, *the Nymphs*, and *the Cupids* are so charmingly beautiful, that they gained for him the appellation of "the painter of the Graces." In his second wife Doralice Fioravanti (the first died at an early age) and his twelve children he had an ever ready supply of the finest models. We find several of them in a picture of the *Holy Family* (*pl.* 17, *fig.* 6), and his little *Cupids* (the Dresden gallery possesses one of the most beautiful compositions of this kind) are for the most part pictures of his children. Albano also painted very beautiful landscapes, and one of them was the occasion of placing the jealousy between him and Guido in a very clear light. Albano was commissioned by Cardinal Barberini to paint a landscape for the king of England, in which Guido was to insert the figures for the fable of Bacchus and Ariadne. Albano executed his task splendidly, so much so that Guido perceived that his figures must remain secondary matters; upon which, losing patience, he seized a large brush and obliterated the entire landscape, and then designed instead of it a naked rock. Albano's drawing is always exceedingly correct, and his coloring is charming. In invention he was rather a poet than a painter; his fancy was inexhaustible, and in his female *Loves* he has remained unequalled. He died in 1660.

Domenico Zampieri, called Domenichino, was born in 1581, and died in 1641. He likewise was a pupil of the Caraccis, and Agostino predicted for him great success. Zampieri was uncommonly industrious, and his acute powers of observation enabled him to note with accuracy the effects of the passions on the human countenance and to depict them to the life. He lived on terms of the most intimate friendship with Albano: and when the latter went to Rome, he soon followed him, and worked there in com-

pany with him. Domenichino at first experienced violent opposition, and his bashful nature was looked upon as weakness; but he was all the more esteemed and honored in the end. The number of his works is great; but the most celebrated is his *St. John*, one of the four Evangelists, which he painted in the church of St. Andrea della Valle in Rome, the cupola of which, as we mentioned above (p. 105), was painted by Lanfranco. There are also some beautiful works of Domenichino in Naples. He ranks indisputably among the most accomplished painters; he made use of the antique with great ability, and in point of expression he stands next to Raphael. His coloring is beautiful, powerful, and natural, and his compositions are for the most part full of grace and spirit.

As painting in Rome, Florence, and Venice, after reaching its most brilliant period, began to decline, so too in Lombardy it now began to approach its fall. The rage for novelty, the numerous rival styles, the eagerness to banish the difficulties of the art and to facilitate its study at the expense of thoroughness, made their appearance here likewise. Although Bologna had become the first school of Italy, still the countless different styles of the pupils of the Caracci combined with the methods of other artists, especially with the followers of Pietro da Cortona, hastened the downfall of art. Among all the pupils of the Caraccis, although they were excellent, but few are distinguished by any peculiar characteristics: they all drew from the same stream, without examining whether its waters were pure or turbid, and but few gave themselves the trouble to ascend to its source. Carlo Cignani, who was born in Bologna in 1628, and died in 1719, was the first to bring about a revolution. He early applied himself to the study of the works of Titian, Correggio, and the Caraccis, and formed for himself an individual manner distinguished by very accurate drawing and great power of coloring. His very first works gained him great reputation and so many commissions, that he was prevented from devoting the requisite attention to his own improvement, by means of which he would otherwise have risen to the highest grade of excellence.

Among the finest works which Cignani has left us are two frescoes, with which he in company with his fellow-pupil Taruffi adorned the Farnese hall in the public palace of Bologna. These two pictures painted by Cignani himself represent, one of them Francis I. of France touching for the king's evil in Bologna, and the other the entrance of Pope Paul III. (Farnese) into the same city. Cignani painted a great deal in fresco, both in Bologna, in Parma, and in other places: in acknowledgment of his merits he had bestowed on him the title of count and cavalier. Besides the innumerable pictures which he painted for many noble houses of Italy, he worked also for the emperor, the king of France, prince Adam of Lichtenstein, and for the elector of Bavaria and the Palatinate. In the city of Forli, where he resided for many years for the purpose of painting the great cupola of the church of the Madonna del Fuoco, he kept his school of painting as he had done in Bologna; and from it a good many tolerably able artists proceeded. His easel-pictures are found in almost every gallery of importance; one of the best of them is in Dresden: it represents Joseph

tearing himself from the arms of Zuleika (Potiphar's wife) (*pl.* 15, *fig.* 8). His last work, which he painted at the close of his life, was an infant Jupiter in the act of suckling; he painted it for the elector of the Palatinate, who rewarded him very generously. The venerable artist died at Forli in the year 1710, and is there buried under the cupola on which he had labored for twenty years, and which he regarded as his masterpiece. In his manner we find a combination of the finest characteristics of Correggio, Titian, Guido, and the Caraccis; yet he followed no master exclusively, but was always original. He possessed a peculiar talent with which nature had also gifted Correggio, that of representing figures in scanty spaces magnified in a wonderful manner. There was a great deal of grace in Cignani's drawing, and he selected only the finest natural forms for models; his coloring is vigorous without too great masses of shade, and his illumination is clear and intelligible.

A school of artists was also formed in Naples and Sicily, which has produced some celebrated masters. We need only mention here the names of Andrea da Salerno (1480–1545), Francesco Penni (il Fattore), Giovanni Caracciola, Giuseppe Ribera (lo Spagnoletto, 1593–1649), Salvator Rosa (1615–73), Mattia Preti (il Calabrese, 1613–99), Luca Giordano (Fa presto, 1632–1705), and Francesco Solimena (1657–1748), to give an idea of the services rendered to true art by this school.

2. Spain. Among all the kingdoms of Southern Europe there is perhaps none that has undergone so many revolutions and had such various rulers as Spain. Phœnicians, Greeks, and Carthaginians were enticed thither by its mines of silver and gold, and these expelled the original inhabitants and established their colonies instead. The Romans transplanted thither their manners and civilization, and many beautiful temples still testify to the architectural skill of the Augustan age. Next took place the irruption of the Goths, with whom the Christian religion found entrance, as is shown by the churches now in ruins of the 6th and 7th centuries. The incursion of the Arabs into Spain introduced a new religion, new manners, and new art, until Ferdinand I. (1047–65) delivered a great part of Spain from the domination of the Moors. From that time forth the Christian religion has reigned unrestricted in Spain. Relics of art are still preserved in greater or less numbers belonging to all these periods; and it is to be regretted that the Pyrenees and still more the intolerance of the Spaniards preserve the Peninsula in such a state of isolation that these ruins and remains of art are still but very imperfectly known in the rest of Europe.

The oldest accounts of Spanish painting relate to the 10th century, when the monk Vigila wrote a codex and adorned it with miniatures; the painters were Saracino and Garcia. There is a Bible in two volumes of the 13th century, with paintings by Pedro de Pampeluna; and in 1291 Esteban Rodrigo was court painter to king Sancho IV. Juan Caesillas painted in 1382 for the city of Reus an altar-piece with the twelve Apostles and many embellishments, for which he received 330 florins of Arragon; and there is a painting of the year 1399 in the cathedral of Toledo by Fernando Gonzales, who was also a sculptor.

In the beginning of the 15th century there came to Spain the Florentine artists Gerardo Starnina and Dello, whose works it is true no longer exist, but which are said to have been very fine. About the year 1462 lived the Spanish artists Juan Sanchez de Castro and Pedro Sanchez; works by both of them are still extant, which as respects delicacy of execution and sprightliness of coloring are of distinguished merit. There also lived in Spain about the year 1455 an English artist named Jorge (George), good portraits by whom are still extant. The first Spanish painter who went to Rome to perfect himself in his art was Antonio del Rincon (1446–1500), who after his return executed many fine works; all, however, have been destroyed with the exception of an altar-piece of seventeen compartments. It is expressive and very clever. Pablo de Aregio and Francesco Neapoli painted in the spirit of Leonardo da Vinci, as appears from two side wings on the high altar of the cathedral of Valencia of the year 1506. At that time Spain was rich in artists, some of whom were of a high order; yet there were also foreigners among them. Johann Cornelius Vermeyen (Juan de Majo or Barbalonga), from Beverwyck near Haarlem, produced church paintings and beautiful landscapes. Titian also remained here for some time, and the great number of paintings by him which are found in Spain (they are reckoned at 85) attest the high esteem in which he was held by the emperor Charles V. and Philip II. Great reputation was gained by Fernando Yarmez, a pupil of Raphael: his best work is the *Adoration of the Kings.* Rubens too spent a considerable time in Spain, of whom we shall have occasion to speak again in treating of the Netherland school. There are also in Spain 96 pictures and 46 designs for pictures by Rubens; yet strictly speaking he was of little benefit to the Spanish school, as the reputation to which he attained was injurious to that of Italy.

Passing over a great number of artists whose enumeration would have led us too far, and of whom we will particularize only Herrera and Velasquez de Silva, we turn to Bartolomé Esteban Murillo (1618–82), who is rightly esteemed one of the greatest painters of Spain and indeed of his time. He was born in Seville and studied the art of designing with Juan de Castillo; but he remained deficient in coloring until he came to rely upon himself and formed his own style. At this period he painted pictures in several churches, which show strong marks of mannerism. Then came Pedro de Moya, a pupil of Vandyck, to Seville; and on Murillo's thus becoming acquainted with the coloring of Vandyck, he determined to repair to that master for instruction, when he received information of his death. Italy then became the goal of his wishes; but being without the means of defraying his expenses thither, he painted an immense number of little sacred pictures which were sent to India. With the money saved from the proceeds he went to Madrid, where under Velasquez he copied the paintings of Titian, Rubens, Vandyck, Ribera, &c.; by this course he profited so greatly that when in 1645 he returned to Seville, he gained universal applause by his paintings in the convent of St. Francis. They were executed in an entirely new style, in the taste of Vandyck, Spagnoletto, and

Velasquez, and gained for him a great number of commissions. His beautiful picture of *St. Anthony of Padua* in the cathedral, which is regarded as his finest work, was painted by him in the year 1656. His most brilliant period, however, was from 1670 to 1680, when among other things he painted the eight pictures in the church of the hospital of St. George, for which he received 78,115 reals. The pictures of Murillo are valued very highly: for instance the English banker Angerstein paid for two of them 18,000 dollars. Murillo possessed an amiable character: he treated the mistakes of his pupils, of whom he had a great number, with gentleness, and referred them constantly to nature. His pictures are to be met with through all Europe; as he was uncommonly industrious, and his works were always held in high esteem. Many too have been given as presents by the kings of Spain to other rulers or have been sold for high prices; and hence it is that no gallery of consequence is without a picture of Murillo, although many of them no doubt were only executed in his school. The Dresden gallery possesses a few pictures by this master, and among them a very beautiful *Madonna and Child* (*pl.* 17, *fig.* 8), which indisputably belongs to Murillo's best period. We find in his pictures two characteristic styles: one is vigorous and powerful and the execution true to nature; while the other shows a certain sweetness which Murillo derived from his manifold studies after Italian masters and after Vandyck, but which he discarded in some paintings of this style found in the Soult gallery in Paris. Murillo left many imitators and a respectable school, which, however, soon degenerated. In Spain also art sank by degrees from the high point to which it had been raised by the masters of the 16th and 17th centuries; and although occasionally one master or another cast a ray of light over the domain of art, no serious revival was produced in it until the advent of Mengs.

3. France. The first traces of painting in France present themselves in the time of bishop Gregory of Tours, who in the 9th century caused many churches to be adorned with paintings; the tomb of Fredegunde was also decorated with mosaic paintings, the execution of which was at that time well understood, the art having been handed down from antiquity. At the time of the Norman invasion (in 865), miniature painting was not unknown in France. There is still extant a manuscript of that period, the four Gospels in the National Library in Paris, which contains several miniatures, among others that of the emperor Lotharius; and there is also a Bible of the time of Charles the Bald containing paintings, among which is one representing the king on his throne surrounded by eleven priests, guards, and magnates of the kingdom. A work has come down to us from the year 1065 which, though not properly a painting, is nearly enough allied to one. We mean the great tapestry of Bayeux, 212 feet in length and over 2 feet in breadth, on which queen Mathilda and her maidens depicted in embroidery the deeds of William of Normandy. To be sure the drawing on this tapestry is truly barbarous; nevertheless it is of great historical importance if only on account of the inscriptions it contains. There are also fresco-paintings of that time, which represent William the Conqueror, his queen Mathilda, and his sons Robert and William, besides other works of

the kind in churches. Miniature painting was brought to great perfection by Foulques, precentor at St. Hubert's; and considerable progress was likewise made in painting on glass. Of greater importance at that time for the advancement of art in France were the exertions of abbot Suger, a zealous patron and promoter of all the arts. A great deal too was done for the arts under Louis IX.; and his expeditions to the Holy Land, his imprisonment, and his subsequent adventures, afforded to painters and sculptors a rich material for illustration. Thus we find a picture of this king of the year 1226, in the Saints' Chapel in Paris, which is painted in very good taste and represents the king with a bird sitting on his left hand and holding in his right a sceptre; and in the abbey of St. Denis there are eight beautiful glass windows of the year 1350 with paintings from the life of that saint.

When in the 14th century the French city of Avignon became a possession of the pope and several popes ruled there, a closer union took place between France and Rome, the proper seat of art, and with this event art advanced considerably in France also. Gaddo Gaddi and Giotto both lived for some time in Avignon; and the latter at the command of the pope painted altar-pieces and frescoes for a number of French churches. In the year 1431 Charles IV. had a court painter, Jean de Bruges, perhaps the father of the famous John van Eyck, who is almost always called abroad John of Bruges.

The history of painting in France properly begins with Francis I. It is true, his own attempts in Italy were crowned with more honor than success; nevertheless he succeeded in transplanting if not the art at least the artists from Italy to France. Leonardo da Vinci was the first, in 1515; but he lived only a few years in France, and died in the arms of his sovereign. Andrea del Sarto soon after, in 1518, entered the service of Francis I. but behaved, as we have seen, very ungratefully towards him. It was with Rosso di Rossi, or Maître Roux as the French call him, who came to France in 1530, that Italian art at length obtained a firm footing in France. Francesco Salviati also remained but a short time in France, and after him the Duke of Mantua sent to Paris Francesco Primaticcio, whom Francis I., after Rosso's death, raised to the dignity of chief court-painter. These Italian artists, instead of educating Frenchmen to be their assistants, drew other Italians to France; and thus French art remained for a long period in a sort of sleeping partnership with the Italian, and nearly all the important works of art which were executed in France were produced by Italians, and this state of things continued till the time of Louis XIV. The only French artists who distinguished themselves under Francis I. were François Clouet and Corneille de Lyon as portrait-painters, Arnoud Demoles as a painter on glass, and Pinaigrier who painted frescoes.

The unquiet reigns of Henry II. and Francis II. witnessed little advancement in the arts; and the massacre of St. Bartholomew's eve under Charles IX. cost many artists, among others Jean Goujon, their lives. A French school properly so called was at length formed under Henry IV., at the head of which stood Jean Cousin, several very good works by whom (he was living in 1589) are still preserved; he also painted a great deal on glass,

e. g. the windows of the parish church of St. Gervais in Paris. He was likewise a sculptor and architect. The artists of those times occupied themselves chiefly in the preparation of cartoons for tapestries, of which Francis I. was very fond; and to this Gilles Gobelin, by the beautiful and durable colors which he succeeded in imparting to the wool, contributed not a little. After the death of Primaticcio, the superintendence of the works at Fontainebleau came into the hands of Ruggieri and the two Frenchmen Du Breuil and Jean Bullant, who there represented the exploits of Hercules in twenty-seven pictures which they painted together. Jacques Bunel and Du Breuil also painted the cupola in the small gallery of the Louvre, which was burnt in 1660; and Freminet, who took Michael Angelo for his model, painted the ceiling of the chapel at Fontainebleau.

Yet notwithstanding all this, in the times of the Caraccis, when art stood in Italy at a high pitch of perfection, French art had hardly attained the first stages of its growth, and the magic creations of the Italian pencil seemed to excite no rivalry in France. The French works remained mean and dry, the drawing was incorrect, the coloring spiritless and without harmony, and there was a lack of the fancy and invention which are indispensable for the production of a genuine work of art. The first great masters proceeded from the school of Simon Vouet; but their successors already manifest a decline in skill. Simon Vouet had acquired his artistic education in Rome and Venice; and we discern in his pictures the effects of his studies after Titian, Tintoretto, Paul Veronese, Raphael, and Michael Angelo. The number of this artist's productions is very great, as he was very industrious, and his ambition led him to grasp at everything, in consequence of which France lost one of her best artists, Poussin.

From the school of Vouet there issued many other masters, Lebrun, Lesueur, Mignard, Du Fresnoy, Testelin, and Dorigny père. His contemporaries were Noël Jouvenet, Percier, Quintin Varin, &c.

Varin's school produced Nicolas Poussin (b. 1594, d. 1665), who rose to be one of the greatest painters of France. After visiting the schools of the most celebrated painters of the time, and finding that he could not derive much further advantage from them, he studied and copied the works of the great Italians, and at last succeeded by dint of severe economy in getting to Rome. Here he studied very diligently and especially the antique. Of all the Italian masters Domenichino became his favorite. His first works of importance were *the Martyrdom of St. Eramus* for the Vatican basilica and the celebrated *Seven Sacraments* for the cavalier Cassiano del Pozzo. Several works of Poussin which had come to Paris excited in Cardinal Richelieu a desire to have him in that city; and in consequence he was summoned in 1639 to Paris, where he was overwhelmed with commissions and was appointed court painter and chief superintendent of all artistic undertakings with a salary of 3000 livres. On account of some works in the Louvre he fell into a dispute with Fouquier the landscape painter and Mercier the architect; and these conspired with Vouet to cause Poussin's overthrow, which at length they effected. Poussin returned to Rome, where he painted a great deal, and where he died in 1665.

Poussin had pursued a peculiar course in the cultivation of his talents: after he had well grounded himself in his art by the study of the greatest masters, he perfected his knowledge in Rome by means of an accurate and diligent observation of the antique, whence his strictly accurate costumes and the learning displayed in the accessories of his pictures, which render them of great value to the archæologist. His drawing is perfect, as is also his expression; his compositions seem to be formed upon his studies from the cartoons of Raphael and Domenichino and on the principles of Leonardo da Vinci. In coloring and in pleasing harmony he remained deficient, and his works were sometimes wanting in fire, as he endeavored to finish them too minutely and according to all the rules of art. His landscapes are excellent in composition, but incorrect in the details. Poussin wished to paint only for the soul, to exercise only the understanding, and not to gratify the senses with luxury of coloring; hence many of his pictures are nothing but moral rhapsodies, which under the guise of a poetic picture excite the beholder to reflection, and speak to his heart.

Claude Gelée (Claude le Lorrain, 1600–1682) was a contemporary of Poussin, whom he survived. His birth being of low condition, he was at first apprenticed to a pastry-cook; but he afterwards learnt drawing of his brother in Freiburg, and went with a relative to Italy. Here he was left without protector or guide, until he obtained employment as a color-grinder of Tassi the landscape-painter, a pupil of Paul Bril, and gained some knowledge of painting, which he afterwards completed under Vals in Naples. He was soon enabled in consequence to take his place in the highest rank of landscape painters; and on his return to Rome, where he took up his abode, he received many commissions from the popes and other persons of consequence. The demand for his pictures caused other artists to paint in his manner and to sell their works as his; so that there exist an immense number of so-called pictures by Claude with which he had nothing whatever to do. In order to keep an account of his pictures, he slightly sketched each one of them in a book, which he called the "Book of Truth." It consists of about 200 leaves: it came finally into the possession of the Duke of Devonshire, and was engraved by Richard Carlom and published by Boydell in 1777. The works of Claude are found in the best galleries; four of the finest are in Cassel, and two in Dresden. The magic effects of light and shade in his landscapes are unsurpassed and hardly rivalled, but the conformation of the ground and vegetation often lack truth and evince mannerism.

One of the most distinguished painters of the French school was Pierre Mignard (1610–95), who made his studies after Rosso and Primaticcio, then joined the school of Vouet, and lastly went to Rome, where he completed his artistic education. He lived on terms of the most intimate friendship with Alphonse du Fresnoy (1611–65), who was likewise in Vouet's school. From Rome they both proceeded to Venice: after some time Fresnoy went to Paris, but Mignard returned to Rome, whence he went to Paris in 1658, and rendered himself equally celebrated as a portrait and as an historical painter. At court he was held in high esteem, but had

much to endure from the jealousy of Lebrun. At the command of the queen-mother of Louis XIV., he painted the cupola of the church of Val de Grace, which is indisputably the greatest fresco executed in France. It represents the abode of the blessed, in the midst of which queen Anne, conducted by St. Anna and St. Louis, presents to God the model of the newly erected church. The picture contains more than 200 figures, the largest of which are 17 feet high. Mignard then decorated with paintings the saloons of St. Cloud, which he finished in four years. After executing other works in Versailles with great success, Mignard had conferred upon him the title of Chevalier; and on Lebrun's death in 1690, he received the appointment of first painter to the king. Mignard's style in some of his works is admirable; his drawing is in the highest degree correct, and his coloring very beautiful. A lack of originality is, however, perceptible in all his works. He had a peculiar talent for imitating to the life the various styles of the masters whom he had studied in Italy; and this he made use of to revenge himself on Lebrun. He painted a *St. Magdalen* in the manner of Guido, and let it be sold by a picture-dealer for a high price. He then caused a rumor to be spread about that the picture was not genuine; and the matter being referred to Lebrun, the latter pronounced the picture to be one of Guido's finest productions. Hereupon Mignard came forward and claimed the work as his own; to prove which he effaced the hair of the Magdalen, when she appeared decked in a red cardinal's cap! and poor Lebrun became the laughing-stock of the town.

Another pupil of Vouet was Eustache Lesueur (1617–55) who completed his style by the study of the Italian masters. He was soon commissioned by queen Anne to adorn the little convent of the Carthusians with 22 pictures from the life of the founder of the order, a work which procured him great reputation. He painted a great deal, especially allegorical and mythological subjects, which in his hands became very unpalatable to refined minds. Lesueur was never in Rome; yet his countrymen place him by the side of Raphael! whom he knew only by a few paintings in France and by engravings. Lesueur's pictures are excellent for his time: what we admire in him is correct drawing, great simplicity, and a coloring which, although not of ravishing perfection, is lovely and free from faults or mannerism. Had Lesueur visited Italy and not died in the flower of his age, he might, it must be admitted, have approached Raphael. His pictures are rare, and it appears that of German galleries Berlin alone can show one of them.

Charles Lebrun (1619–1690) was born in Paris, and received from his father, a sculptor of moderate abilities, his first instructions in drawing and sculpture. He then applied himself to the study of painting in the school of Vouet, but soon saw that the instruction he there received would not suffice; accordingly he repaired to Fontainebleau, to study the works of the Italian masters. Here his progress was such that the king conferred upon him a pension to enable him to go to Rome. He there studied, under Poussin's direction, chiefly the works of Raphael. Upon his return in 1645, he began two large pictures, the *Crucifixion of St. Andrew* and the

Martyrdom of St. Stephen, whereby he founded his great reputation. These were succeeded by a host of other pictures, of which we can particularize only that celebrated one, painted by him at the king's command and in his immediate vicinity, in which the artist represents Alexander after the battle of Issus, at the moment when, accompanied only by his friend Hephæstion, he visits the family of Darius. Lebrun was loaded with the highest honors and rewards, and became a sort of monarch of art in France. Innumerable are the designs which Lebrun executed, and which were transferred to tapestry or wrought into pictures by other artists under his supervision. About this time Lebrun completed some pictures which are connected with the one mentioned above; they are *Alexander's Entrance into Babylon*, the *Battle of Arbela*, the *Defeat of Porus*, and the *Passage of the Granicus*. Of the last named picture we have given a shaded sketch (*pl.* 17, *fig.* 10); which will serve to convey an idea of the rich and animated compositions of this master, and to show how admirably he disposed his masses and managed his illuminations. The costume is everywhere strictly observed; and all is planned in such a manner as to form a living whole, that cannot but delight the connoisseur. As Lebrun's coloring is not quite perfect, the beautiful engravings of his works by Audran generally please connoisseurs better than the pictures themselves. The last great work to which Lebrun put his hand was the gallery of Versailles, in which he represented in allegorical pictures the exploits of Louis XIV. from the Peace of the Pyrenees to the Peace of Nimeguen; but unfortunately they are wholly unintelligible without a commentary and altogether failures in art.

Before Lebrun, the imitation of the good Italian schools was a predominant feature in all the works of the French. But after his time, the French school received a direction which carried it constantly further and further from the true principles of art, and the artists followed certain talented masters, as Coypel and Jouvenet, who exceeded the limits of the good and beautiful, pushed expression to exaggeration, sought to represent everything in violent action, and would rather satisfy the eyes of the courtiers than the judgment of connoisseurs. Hence we pass over the next succeeding painters; for they only prepared the way for the decline of art in France which Louis XIV. was unable to prevent, in spite of all his exertions and the enormous sums which he expended for the purpose. The feeling for the ideal had vanished, and there was no longer an eye for beauty or an appreciation of truth. The only artists who did not wholly suffer themselves to be borne along by the downward stream were the Vanloos (Jacques, his son Louis, and his grandsons Jean Baptiste and Charles André and their sons), and also Pierre Subleyras (1699–1749), though this last is better known in Italy than in France, as he there executed his chief works. François Lemoine (1688-1737) likewise deserves favorable mention.

Jacques Louis David, born in Paris in the year 1748, was the founder of a new French school, which strove to extirpate the old abuses and to promote the growth of true art. He was a pupil of Vien, and applied

himself in his youth to the painting of battle-pieces; but when in 1774 he had gained the great prize of the Academy, he went to Rome and perfected himself by the study of Raphael, Michael Angelo, and the Caraccis, without, however, taking their best works only as his models. One of his first pictures, that of *St. Roque healing those smitten with the Plague*, laid the foundation for his future fame. Afterwards, by way of competing for the prize, he painted his *Belisarius;* but having been treated with undeserved contempt by the then director Pierre, he withdrew the picture and sold it immediately at a much higher price than the amount of the prize. In the year 1787 he finished in Rome his *Horatii receiving their swords from their Father*, certainly his most brilliant production, and which spread his reputation most widely; still this picture is by no means free from faults, for, notwithstanding the correctness of the drawing, the composition is so defective, that the whole suggests the idea of an old subaltern officer exercising three recruits, and these, like all David's Romans, have the appearance of so many Talmas decked out for the stage. The genuine expression of feeling and passion is altogether wanting in the picture; and the fact of its receiving such immense applause shows to what a low ebb the arts had then sunk in France. Another picture of the like stamp is his *Brutus condemning his Son;* it was painted in 1789, and many prefer it to the Horatii. During the reign of terror, David was the intimate friend of Robespierre and also president of the Convention, in which capacity he voted for the death of Louis XVI. It was thus in conformity with his sentiments that he painted so many revolutionary scenes, although his zeal was likewise excited by other subjects. Thus he painted the *Death of Socrates;* and his *Sabine Women*, which he exhibited for some months at an admission of 36 sous, brought him over 60,000 francs. Afterwards, under Napoleon, David was held in high consideration; but on the restoration of Louis XVIII. he was tried as a regicide, and was exiled and went to Brussels, where he died in 1826. While David has the merit of having aroused art from its torpidity, he is to be censured for having led it astray by his exaggeration, affectation, and theatrical scenery.

Among the members of the school of David we distinguish François Pascal Gérard, who conferred so much honor upon this so-called Classical school. He was born in Rome in 1770, but returned to France with his father and studied under David. He lived at first in great indigence, and supported himself during the Revolution by working for booksellers. In his eleventh year he composed a picture representing the *Plague* which excited the applause of amateurs; but it was his *Belisarius*, now in the Leuchtenberg gallery in Munich (*pl.* 18, *fig.* 14), which first made his name celebrated. We behold in this picture the noble and unfortunate Belisarius, bearing on his arm the stripling who served as his guide, and who is now mortally wounded by a snake that still hangs coiled about his foot. The background of the picture is lighted by the rays of the setting sun. Another very beautiful picture by Gérard is his *Cupid and Psyche*, now in the Palais Luxembourg in Paris; and besides these and a great number of portraits, he painted the *Four Ages of Life*, and for Napoleon

the *Battle of Austerlitz.* At the time of the Restoration, he painted almost all the sovereigns then in Paris; he afterwards painted the *Entrance of Henry IV.*, the *Coronation of Charles X.*, &c. He died in 1837. He excelled his master in coloring and in truth to nature.

In opposition to this classical school there arose another called the Romantic school, which distinguished itself from the former by its predilection for middle age subjects and forms. To this class of artists belong Abel de Pujol, Richard, Ingres, who make choice chiefly of religious subjects and Raphaelesque forms, Delacroix, Ary Schäfer, and Delaroche. The four last, and foremost among them Delaroche, with Horace Vernet, are the coryphæi of the French school of our day, whose performances in historical painting far excel those of the previous French schools and approach the solidity of the newest German art.

One of the most highly esteemed painters of David's school was Anne Louis de Girodet-Trioson, who was born at Montargis in 1767, and died in 1825. As early as 1790 he made himself a name by his representation of the *Story of Joseph and his Brethren;* and this gave him courage to paint another picture, the *Sleeping Endymion* (*pl.* 18, *fig.* 13), which attained equal celebrity. Endymion slumbers in a charming posture, while Zephyr thrusts aside the overhanging branches, that Diana, in the shape of the Moon, may more easily let fall her rays upon the lovely sleeper. This chef d'œuvre Girodet painted while in Rome in 1792. He likewise painted a scene from the *Deluge*, which together with the Endymion is preserved in the Luxembourg palace; this was followed by the *Surrender of Venice*, the *Revolt in Cairo* (in the Paris Museum), *Pygmalion and Galathea* (in the collection of Count Sommariva), and many others. Girodet's drawing is faultless, his coloring beautiful, and the many portraits which he painted are striking likenesses. Antoine Jean Gros is another painter who reflects honor on the school of David. Of his portraits those of *Napoleon on horseback* and *Napoleon on the bridge of Arcole* are the most celebrated; his historical pieces are also excellent.

Another artist of the classical school is Guérin, who as early as 1796 exhibited two pictures, *Geta murdered at the command of his brother Caracalla*, and *Coriolanus's Delivery from Death*, in which was discerned the great master that he afterwards became. His finest picture was exhibited in 1799 in the hall of the Louvre: it represents Sextus on his return home after having escaped the proscription of Sylla, when he finds his wife dead and his daughter weeping at her feet. The picture was purchased by a private individual for 10,000 francs. Guérin also executed some small pictures in a pleasing style, *e. g. Two Lovers bound by Cupid*, &c. His *Orpheus at the Grave of Eurydice* is one of his last and finest works; equally praiseworthy is his *Phædra and Hyppolite* after Racine, and the *Offering brought to Æsculapius* (*fig.* 5), the idea of which he took from one of Gesner's idylls. Noble simplicity, purity of design, and a vigorous and easy sweep of the brush, are the excellences remarked in the works of Guérin. He is, however, not free from the theatrical affectation belonging to the school of David.

France has also its school of higher genre and historical painting; in which, besides the great historical painter Delaroche, Horace Vernet, Robert, Schnetz, Decamps, and Lessore have obtained a distinction eminently surpassing that of any earlier master.

4. Germany. The first beginnings of German painting have perished with the buildings that contained them. We have specimens of them, however, in the *miniature paintings* or *illuminations* of the old manuscripts; for while the splendid edifices of Charlemagne have long ago fallen into undistinguishable ruins, the books which were written for him and adorned with paintings, are still preserved almost uninjured in Treves, Bamberg, and Munich. One of the oldest genuine German illuminated manuscripts is a missal in the Bamberg library, which dates from the 10th century and contains twenty pictures representing sacred subjects distributed through the 223 leaves of text. These pictures exhibit coarse and uncertain outlines; while their bright and broken colors show that they are the offspring of ancient art. So too an evangelistary of the same period and in the same library exhibits some very interesting and peculiarly disposed symbolical paintings. The pictures, which present a very rude appearance, have violet and brick colored flesh, and are very feeble in design; but the ornaments still manifest an adherence to ancient tradition. Another manuscript in the Bamberg library, once the property of empress Kunigunde, contains sixty-one illustrations of the Revelation of St. John, which are very weak in invention. This MS. is of the 10th century, and exhibits as yet but little Byzantine influence; the execution is artless, and is little more than a mere laying on of colors without light and shade. The flesh parts are pale and brownish: the other colors bright but broken. The illuminations of the Tristan manuscript in the library at Munich, which dates from the first half of the 13th century, have still more the character of mere outlines; they lack that attempt at pictorial effect which is observed in the Belgian and French works of the same period. The miniatures of the 14th and 15th century begin to exhibit the influence of the Cologne school of painting; and in the 16th century Sebald Beham and Hans Glockendon distinguished themselves as miniature painters.

Next to miniature-painting in importance as illustrating the history of art in the middle ages, is the art of *painting on glass.* It is a purely German invention; and its first traces appeared in the 10th century, when a certain Count Arnold presented the Bavarian convent of Tegernsee with painted windows, and when Theophilus Presbyter made known rules for painting on glass. Probably then the origin of the art was in Bavaria: an abbot Wernher of Tegernsee, who lived at the close of the 10th or at the beginning of the 11th century, is mentioned as the first glass-painter, and to German masters the rest of Europe is indebted for this art. At first glass-painting was, properly speaking, a kind of mosaic: for the stained glass was colored in the mass and the only color laid on was black, with which the outlines of the features, the folds of the garments, &c., were delineated. Afterwards the glass used was white with a colored coating and the colors laid on were blue, green, and occasionally yellow. Glass-

painting, as the handmaid of architecture, preserved always an architectural character, even as late as the 13th century, when all other kinds of painting were practised without any such restriction. Of great importance for the history of this kind of glass-painting are the windows of the high choir in the Cologne cathedral, and those in the church of St. Catharine in Oppenheim dating from the middle of the 14th century, as also the works of about the same period in the nave of the Strasburg minster, most of which were painted by Hans von Kirchheim. From the 15th to the 17th century dates the most flourishing period as well as the decline of this art Although in technical details it became greatly improved, its chief character was always that of ornament. Coated glass of different kinds came into use at this period, new fluxes were invented, and several colors were annealed on one and the same glass plate; so that a kind of cabinet-painting arose, which represented scenes and figures from the Bible history, coats of arms, &c. Artists came to Germany from abroad to learn this art, *e.g.* Francesco Livi of Gambari near Volterra, who came to Lübeck; glass-paintings by him of great perfection are still extant in Our Lady's church in Lübeck. This artist painted in 1436 the windows of the cathedral in Florence. Of German glass-painters of the 15th century we will mention Peter Acker (1460) in Nördlingen; Hans Krämer, who worked in 1480 on the cathedral and town-hall of Ulm; and Hans Wied, who worked at the same period on the Ulm minster. The principal family of glass-painters, the Hirschvogels, worked in Nürnberg, and Veit Hirschvogel painted (in 1527) the "margrave window" in St. Sebald's church, in which margrave Frederick of Ansbach and Baireuth is portrayed with his wife and ten sons, after the designs of Hans von Kulmbach. This window and one furnished by the emperor Max, besides another by the Pfinzing family, all by the same master, are certainly among the finest works of the kind. Lucas Zeiner painted in 1503 a window for the abbess of the nunnery in Zurich; and here flourished in the middle of the 16th century Josias Maurer, who with his son Christoph (d. 1614) distinguished himself both in composition and drawing. Other painters of the 16th century are Hans and Claus Glaser, Schondorf, Hans and Georg Hebenstreit in Munich, &c. The finest paintings on glass are to be found in the various churches of Cologne; but unfortunately it is not known by whom they were painted. The change in the style of architecture caused glass-painting to be dispensed with, and thus the art fell into disuse, although the knowledge of it was not wholly lost; for when in the present century it was desired to have the windows painted in the Regensburg minster, Sigismund Frank of Nürnberg soon recovered the process, and a school of glass-painting was formed in Munich which produces excellent things. In Prussia, Gersdorf and Mohn applied themselves to this branch of art; and now excellent works are produced chiefly in Bavaria by Hemle, Schwarz, Kirchmayer, Ainsmüller, Wehrsdörfer, v. Gärtner, Hoss, Hämmerl, Bertram, &c., whose performances greatly surpass those of earlier times in artistic composition and execution. Painting on glass is also practised in the porcelain manufactory of Sevres, but in a style inferior to that of Munich.

Wall-painting never flourished in Germany to the same extent as in Italy, for the reason that in the German style of building the masses of wall are diminished as much as possible, and cupolas are replaced by cross-vaults. Still there were always places to be found for the application of fresco-painting; but we have only scattered instances of what German art has been able to accomplish in this respect, for not long ago there was such a fondness for white that even painted walls and vaults of churches were whitewashed over. Of great importance here are the newly discovered paintings formerly hid by tapestry in the cathedral of Cologne, representing the legends of the three holy Kings and pope Sylvester. These pictures, which date from the 14th century, show already a very decided effort in an artistic direction. The first German fresco-painters whose names have been handed down to us were Nikolaus Wurmser and his brother Kunzel of Strasburg, who painted in the cathedral in Prague and in the church of the Theatinians on the Karlstein. Along with them worked Theodoric of Prague, who surpassed them in drawing. Master Wilhelm of Cologne painted in St. Severin a large picture, which unfortunately has been a good deal painted over again; he also painted a *Crucifixion* in a church in Coblentz. Ulrich of Maulbronn executed in the 15th century several wall-paintings in the church of that place; there are also some secular paintings on the walls of the Ehinger Hof in Ulm. Important for this branch of art are the *Dances of Death* executed in this and the following century, which were often painted on the churchyard walls and sometimes in the churches themselves, and which are replete with satire against the priestcraft of that time. Unhappily the most considerable works of the kind, the *Dance of Death* in the Klingenthal convent in Kleinbasel, and that of the younger Holbein on the churchyard wall of the former church of the Dominicans in Basel, are no longer in existence. That however in the inner church at Strasburg has been saved, as it lay under a coating of plaster, which has been cautiously removed. There are five pictures with figures above the size of life; the heads are characteristic, and the colors (original or restored?) are tolerably lively. Holbein's *Dance of Death* was copied in 1806, shortly before the wall was pulled down, by Rudolf Feierabend; he executed his task better than Emanuel Büchel, a baker, who had copied it in 1773, after executing a colored copy of the *Klingenthal Dance of Death* in 1768. Both drawings are now in the library of Basle. Fresco-painting has recently been revived with much success in Bavaria and also in Prussia; and the works of Cornelius, Kaulbach, Heydegger, Hess, Zimmerman, and others, show to what a high pitch of perfection it has again been brought.

We have here used the term *fresco-painting* in the sense in which it is commonly adopted, namely to designate the art of decorating fresh-made walls with paintings, which, becoming dry together with the plastering of the walls, acquire a certain degree of durability. This art is the result of the endeavors to imitate the Egyptian wall-paintings, whose durability amounts almost to perpetuity. The chemical process by which the Egyptians succeeded in handing down their wall-paintings through thousands

of years has not yet been discovered (see Architecture, p. 10). On the other hand, modern art has gained great triumphs over the ancients in the composition and design of these wall-paintings, succeeding, as it has done, in spite of the necessarily hurried execution of fresco-paintings, in imparting to them the same ease of motion and drapery and the same delicate effects of light and shade that characterize the most elaborate easel-painting. It is with regard to this great accomplishment that modern fresco-painting may lay claim to the highest appreciation, being in fact an entirely new art. From the architectonic point of view it is as yet far behind the technical perfection of the Egyptian art, and it is therefore unjustifiable to employ it in the exterior decoration of buildings, as has been freely done in recent times; for, as it cannot resist the influence of the weather for any considerable length of time, it tends, after a short period of splendor, in its decay to destroy the beauty of the edifices which it was intended to enhance.

We now come to the easel-paintings; and in this department the works of the 13th down to the close of the 14th century have already something grandly religious to show. The figures are simple, and the features are typical, ideal, and dignified. The draperies have large round folds simply arranged, and the colors are bright. The general mode of painting is in distemper, with the white of eggs for an agglutinant, on a chalk ground and on panels of wood, which were sometimes covered with canvas. The entire ground was gilded or ornamented with gold, and many parts of the pictures were adorned in like manner. Paintings were also executed on slate; indeed the oldest picture, which bears the date of 1224 and is preserved in the church of St. Ursula at Cologne, is painted on that substance. The first master of eminence is Hans of Cologne, who settled at Chemnitz in 1307; he there adorned the high altar of St. James's church with a large altar-piece, and in the church of Ehrenfriedersdorf he decorated the altar with the side wings and many gilded figures. We have panel pictures too of the date of 1310 by the above mentioned fresco-painters Wurmser and Theodoric in Prague and on the Karlstein; and here these masters founded a school of their own. There is likewise a *Crucifixion* by Wurmser in Vienna; but the works of Theodoric are the better of the two. Oil-painting was brought into use at the close of the 14th century by the brothers Van Eyck. Of much more importance than the Prague school was that founded in 1380 by Master Wilhelm at Cologne, the art of which at the opening of the following century had attained a singular state of perfection. Master Wilhelm's pieces display a mild and gentle character; the forms of the heads are roundish, the draperies full and majestic; the colors are bright, well blended, and light, and are soft and airy in their texture. Of Master Wilhelm's works the following should be mentioned: the altar of the chapel of St. John in the cathedral of Cologne, the altar in the city museum of Cologne, the *Veronica* in the Munich Pinakothek, and a couple of panels in Boisserée's collection. Somewhat younger is Master Stephan of Cologne, the chief painter of the cathedral. From him we have the famous picture of the *Adoration of the Kings*, which

has been brought from the chapel of the city hall into the cathedral. This precious picture is said to have been completed in 1410. The central piece, $8\frac{1}{3}$ feet high and 9 feet broad, represents the child Jesus sitting on the lap of the holy virgin, while before him the three wise men of the East are offering gold, frankincense, and myrrh. On the two wing pieces are depicted the patron saints of the city, St. Ursula and St. Gereon with their attendants. The expression of the Virgin's countenance, as she looks down upon the child, is serious and modest, soft and winning. She is designated by a crown and a halo of glory as queen of heaven. The child, which has an exceedingly intelligent expression of countenance, raises its hand in the attitude of benediction towards the old king who reverently regards it. The second king, who is represented in the prime of life, presents his gifts kneeling with an expression full of reverence and devotion; and the third, who is designated by his swarthier complexion and frizzled hair as a Moorish king, humbly lays his left hand on his breast, and presents his offerings with his right. The men composing the numerous train present a most charming group of faces. On the outer sides of the wings of the painting is depicted the Annunciation. Masters Wilhelm and Stephan left many pupils, and there still exists a considerable number of pictures by them. It is true that these pupils exhibit among their number no very distinguished painters, yet there were always very respectable artists among them who remained true to the national style and sentiment. A pious and fervent conception mostly of biblical subjects, a rich and juicy coloring, and an attractive unartificial mode of treatment characterize the painters of this school, especially in their smaller pictures.

After Master Stephan there arose a later school of Cologne and also that of Calcar, on which however the influence of the Netherland school is perceptible. Two masters distinguished in this direction are the so-called Master of Calcar, by whom is the panel containing the *Death of Mary* preserved in the parish church of that place, and the Master of *the Passion*, a picture consisting of eight panels formerly in the possession of Mr. Lyversberg in Cologne. There are several other pictures by this latter master, whom Boisserée calls Israel of Meckenem, in Lintz, Sintzig, and other places. Besides these we must mention a third master of Cologne, whose pictures are often ascribed to Luke of Leyden. He is the painter of the *St. Bartholomew* on a panel in Munich, of a *Descent from the Cross* in Paris, and several other things. His mode of treatment is softer than that of Luke, his heads are mostly ideal, and the coloring and draperies of his pictures are admirable; but his figures, especially his hands, are faulty.

The productions of the Cologne school, which often bear the closest resemblance to those of the Netherlands, are greatly surpassed in interest by the pictures of the Suabian and Westphalian schools, which truly and worthily represent the old German style of art, whose grand aim is the embodiment of ideal loveliness. Here belong Lucas Moser of Wil (1430), who painted the altar-panels in Tiefbronn near Pfortzheim; and likewise Martin Schongauer of Kalembach (Martin Schön or der Schöne Martin), whose works manifest an artistic tendency similar to that of Pietro Perugino,

and of whom Wimpfeling says that it was not possible to paint anything more lovely, charming, and delightful than the pictures of this master. He painted about the middle of the 15th century in Ulm and Neuenburg in Wirtemberg, and afterwards in Colmar, where he died in 1488. His pictures exhibit a high order of beauty in the cast of the human countenance; and he was careful both in the charm of expression and in the representation of the softest and gentlest feelings of devotion, resignation, and peace of mind, to portray the ideal furnished him by the piety of his native region. He was also very successful as an engraver. Besides these South German masters there was in Westphalia the Master of Liesborn, whose labors were directed in his own peculiar way to the same end with those of Schongauer. His greatest work is the altar-piece, painted in 1465, in the convent of Liesborn near Münster. In his pictures there is reflected the most intelligent sweetness brightened into a loveliness that is absolutely charming, and combined with very delicate coloring and noble forms. A contrast to this painter is furnished by Jarenus of Soest (1450–1500), in whom there was something fancifully passionate, which discloses itself in his long lank forms and overcrowded composition. His masterpiece is the *Christ taken Captive*, in which are seen also Christ bearing the Cross, together with his crucifixion, burial, and descent into Hell. Another painter of analogous skill and taste was Master Raphon of Eimbeck, who lived in the 15th and 16th centuries, and who painted the *Crucifixion* in the cathedral at Halberstadt. The works of this and of the preceding master remind us forcibly of the Netherlandish element, which however the masters of Southern Germany in the latter half of the 15th century knew better how to make use of in the way of perfecting their own style.

Another painter who manifests a similar tendency to that of Schongauer in his works is Bartholomew Zeitbloom (1468). His pictures are pervaded by great dignity and good sense, and the expression is homely and honest; but the ideal beauty of Schongauer is wanting. His compositions are simple, his countenances fine and engaging, and his flesh tint delicate, clear, and ruddy. Next to him should be mentioned Hans Schühlein of Ulm, whose compositions are richer, and whose forms are cast in a more powerful mould. The altar-piece in Tiefenbronn is by him. Hans Holbein the father (of Augsburg) also approximates to the Schongauer school, although a certain fantastic exaggeration is observable in his characters. He worked very unequally, often almost mechanically; yet everywhere the great energy of this master is exhibited in his expression of the passions, and in the strength and richness of his coloring. We have still to mention Frederick Herlin, who studied in the Netherlands and spread the manner of Van Eyck in France; he was likewise a carver. His motivos show plainly the influence of Hans Hemling: the folds of his draperies, the use of costly stuffs, the richness of the colors, and even the architecture and buildings, all remind us forcibly of that master; while the deviations from him are mostly for the worse.

Among the various German schools which originated in the 15th century the Frankish school of painting, the centre of which was Nürnberg, was by

far the most considerable. It was formed about the same time with that of Cologne, and is characterized by great vigor and variety of conception and representation, great liveliness of coloring, and careful execution, but all accompanied by hardness of drawing and to some extent a want of taste in character and drapery. The most distinguished master of the first period of this school is Michael Wohlgemuth, in whom the striving after sharply defined characteristics exhibits itself in a very one-sided manner; but who admirably succeeded in giving to figures possessing an ideal significance a character of lofty dignity combined with a certain beauty. To his chief works belong the altar-paintings in St. Mary's church at Zwickau, a few pictures in the church of St. Sebaldus at Nürnberg, and the panels of the high altar at Schwabach (1507). The second and more brilliant period of the Frankish school opened at the commencement of the 16th century with Albert Dürer, a pupil of Wohlgemuth, who to the rational principles of his master added an uncommonly fine eye for the forms of life and a keen perception of even the slightest changeful manifestations of feeling. To extraordinary fertility he joined cleverness of invention and the endeavor to found drawing and perspective on a scientific basis; besides which he manifested uncommon skill and dexterity in the use of the different technical materials. He is equally great as a painter and as an engraver on wood and copper, and his productions in the last named branches form the most considerable part of his works. He painted almost altogether on wood, but also on canvas: thus his *Hercules shooting at the Harpies* (now in the Landauer Brüderhaus at Nürnberg) is executed in distemper on fine canvas. At this period the old German art of painting attained its most flourishing condition; and it is a characteristic fact that at the close of the middle ages the German artists quitted more and more the pious region of an extremely one-sided ideality in which they had formerly delighted, for the bright and living domain of reality. The ideal in the heads almost wholly disappears, and a living and natural expression takes its place. The compositions become rich, the heads are often portraits; the figures acquire a correct expression; the draperies appear in small, interrupted, skilfully designed folds; and the use of gold gradually disappears altogether. Only the figures of Christ, the Virgin Mary, and the Apostles are draped in the ancient manner; all else appear in the costume of the time of the master. The pictures are on wood, mostly linden-wood, with a chalk ground, sometimes laid on canvas glued to the panel; but they are also painted on canvas without any ground.

Contemporary with Dürer flourished Nikolaus Manuel of Bern, who bears the surname of "the German," and is distinguished for correct and sharp drawing, an extremely dexterous management of the brush, and often an elegant arrangement of the figures of his pieces. His invention is rich, and his glowing humor often seizes upon and embodies the fantastically comic elements of the time with magnificent hardihood. In Basel there are several works by him; his chef d'œuvre was a *Dance of Death* on the churchyard-wall in Bern; but it now exists only in a drawing in that city, the original having been destroyed in 1560. Hans Holbein the younger is

a master whose name is of historical importance as relates to art. He came betimes with his father to Basel; but being very industrious, and not finding sufficient employment for him there, he set out upon his travels. He went with recommendations from Erasmus and Sir Thomas More to England, where he ever after continued to reside. He attained to very great eminence, especially in portrait-painting, and, although his treatment is entirely different, he can be placed on a level with Vandyck, while he has often been compared to Leonardo da Vinci with respect to style. With all this he is thoroughly German. His best pupils were Christoph Amberger of Nürnberg and Hans Asper of Zurich, whose portrait of *Zwingli* is universally celebrated. Two very distinguished church painters of the 16th century were Martin Schaffner of Ulm and Hans Baldung of Gemünd. The first mentioned drew his forms so fine and full as to remind us of the best Italian masters, and his conceptions are rich in original and spirited motivos. His flesh-tint is clear and inclining to yellow, and indeed his entire coloring appears rather cold. There are pictures by him in Munich and in Nürnberg. Hans Baldung (also called Grien or Grün) painted beautiful, characteristic heads; but his bodies were often stiff and inelegant. The altar-piece in the minster at Freiburg in the Breisgau is from his hand (1516), and represents the *Crowning of the Virgin.* There is something awkward in the disposition of the picture. The Virgin is the best executed figure: modesty and humility are her characteristics. God the Father looks like a patriarch, nor is the Christ very noble in appearance; his attitude and form too are inelegant. Some of the angels are beautiful and full of expression. The coloring is powerful. The remaining works of this master manifest a strong tendency to the Nürnberg manner; he was a friend of Dürer's.

In Cologne the art at this period exhibited still a character bordering on that of the Netherland school: yet there were then living some distinguished masters, *e. g.* Hildegard of Cologne, Hans of Melem, and Bartholomé de Bruyn, who painted (in 1536) the pictures on the high altar in Xanten. In Westphalia, Ludger zum Ring and his son Hermann zum Ring show evidences of study and imitation of the Italian masters.

The Augsburg school had for one of its principal masters, in the beginning of the 16th century, Hans Burgkmaier, who, although a friend of Dürer's, retained his own peculiar character. His drawing is not as good as that of Dürer, but in harmony of coloring and aerial perspective he is the latter's superior; still a certain coldness pervades his works. Burgkmaier was likewise a wood-engraver, and most of the cuts for the "Weisskunig" (Cologne, 1514) are by him. He is one of the most productive masters of the German school, and his pictures are found in several galleries, though the best are in Nürnberg. Matthäus Grunewald of Aschaffenburg, who was a rival of Albert Dürer, formed himself independently of these schools. He wrought a great deal in Mayence, although there are also paintings by him in the cathedral at Aschaffenburg. His conceptions are grand, his drawing correct, his heads characteristic, and his flesh-tint clear. One of his pupils was Hans Grimmer, who was living in 1650, but whose works have mostly perished.

Of Dürer's pupils but few approached his perfection: the most talented was Albert Altdorfer, a Swiss, born in 1488, whom many call the Rembrandt of the Nürnberg school. One of his finest pictures is the *Battle of Alexander* in the Pinakothek in Munich. Next to him should be mentioned Heinz of Kulmbach, Hans Schäuflin, who in some points almost reached his master; Heinrich Aldegrewer, and the two Behams, who, however, are better known as engravers on wood and copper. Georg Pentz left Dürer's school for that of Raphael.

The Saxon School was founded by Lucas Kranach, who, born in Franconia and formed in the Frankish school, transplanted the Nürnberg style of painting to Saxony. He enjoyed the greatest consideration next to Dürer among the artists of that time. Portraits were his forte, and his smooth handling, which at the same time is entirely free from a licked or labored appearance, is peculiar to him. In his conceptions he has much in common with Dürer; though in him naiveté and good humor are more predominant. His works are very numerous; we will mention only the altar-piece in the cathedral at Meissen, a picture in the chapel of St. George in the same place, and the altar-pieces in Schneeberg and in Our Lady's church in Halle; the two last are considered his finest pictures. Among his many pupils none but his son, Lucas Kranach junior, attained to any celebrity. His chief work is in the town-church in Wittenberg.

The new German School dates from the end of the preceding and the beginning of the current century, when the new flight taken by the national mind of Germany soon manifested itself in the arts of design. The characteristic features of this period are the choice of important subjects, significance of conception, and peculiarity of treatment. The choice of subjects was confined almost wholly to classical antiquity, the biblical history, and the Divine Comedy of Dante. But there the mode of treatment usual in the academies would not suffice, nor was any particular charm to be acquired through the usual means of art; accordingly they depended mainly for success on the conception of the subject and the drawing. The beginnings of this school, however, are to be sought not in Germany but in Rome, whither, from the middle of the 16th century, all men of artistic talent repaired, to perfect themselves in the knowledge and practice of art. The principal artists of this class were Carstens, Schick, Wächter, Koch, and Dietrich. This last was born in Weimar and painted at an early age in Dresden; but his pictures of that period were destroyed in the Seven Years' War. He went to Italy in 1742, and studied the great masters in Venice and Rome. His taste, however, led him to the imitation of Poelenburg, Waterloo, and Rembrandt; and in fact he imitated these masters with such chameleon-like success, that his pictures in the manner of one or the other of them may easily be mistaken for works of the master himself. His fame had spread so on his return, that he received commissions even from France and England. There is found in the Paris Museum an *Adoration of the Magi* by Dietrich (*pl.* 18, *fig.* 12), the composition and execution of which rival the works of the first masters. Besides a number of pictures in the spirit and taste of Rembrandt, we have more than 200 very fine engravings

on copper by him. Tischbein, Füger, Grassi, and Von Langer are also of the number of those who distinguished themselves, although in an opposite manner. The German Artists' Union, founded in Rome in 1811, had the effect of adding heartiness to the prevailing character of the painting of that time; although we observe here and there a somewhat mystical tendency and in the drawing an approximation to or at least a preference for the older school, whose forms of art are but incompletely wrought out. The choice of subject was now confined in a good measure to the New Testament and the cycle of legends. The most celebrated masters of this period and phase of art are Cornelius, Overbeck, W. Schadow, Veit, Jul. Schnorr, and afterwards Wach, Hess, Vogel, the brothers Riepenhausen, Begas, Näcke, and J. Scheffer. The exertions of king Louis I. of Bavaria gave birth to a new era for art in general and painting in particular; at the same time he recalled fresco-painting from its oblivion by the commissions for great wall-paintings which he distributed among the most celebrated masters of the age, *viz.* Cornelius, Schnorr, Hess, Zimmermann, and Schlotthauer. In this manner was formed the Munich school of painting, from which have proceeded, in addition to a great number of excellent easel-pictures, the frescoes of the Glyptothek, the Royal Palace, All Saints' Chapel, &c., and by the younger artists, Hermann, Von Schwind, Schorn, Stürmer, and Stilke, the frescoes of the arcades of the court garden, the Odeon, the protestant church, the Isar gate, &c. The opposite of the Munich school, the school of the ideal forms, is found in the Düsseldorf school under W. Schadow, which may properly be termed a school of naturalists, as they combine a faithful imitation of nature in conformation and coloring, with richness of thought and feeling, without attempting any peculiar idealization of forms. The most distinguished masters of this school are Lessing, Bendemann, Hildebrand, Hübner, Sohn, Steinbrück, Köhler, Camphausen, Hasenclever, and Leutze. The last named, at present in America, was born in Germany, and received his artistic education in Düsseldorf, although he lived the greater part of his youth in Pennsylvania. His great talent and true artistic zeal have gained for him a place among the first of his school. In Frankfort on the Maine, Veit formed a school of painting, in which, among others, we find Rethel, Steinla, and Settegast; while the Vienna school adhered more to the manner of Overbeck. To this latter belong Ruppelwieser, Führich, Binder, and many others. In Dresden, Bendemann and Hübner, being invited to take up their abode there, gave that direction to art which has been followed up by Peschel, Richter, Oehme, and others. In Stuttgart, Gegenbauer (frescoes) and Dietrich pursued nearly opposite paths; in Berlin, Begas and Wach took the lead, and were followed by Hensel, Hopfgarten, and others; but at present Kaulbach of Munich, the most eminent of all German painters, exerts his powerful influence on all lines of art in Berlin. In Prague, Ruben, a pupil of the Munich school, labors for the revival of art, which in the middle ages (see p. 122) was pursued here with a good deal of success. The number of genre painters at the head of whom stand P. Hess, Hübner, Schrödter, and others, as also that of landscape painters, is considerable. Among the

latter Lessing, Achenbach, Funcke, and many others have distanced the best productions of any previous period.

5. The Netherlands. Contemporaneously with the schools of painting in Westphalia and Cologne, there was formed in Ghent and Bruges, and throughout the Netherlands, a peculiar school of strict naturalists, rich indeed in fancy and deeply imbued with ecclesiastical and Christian symbolism, but wholly incapable of or indisposed to the production of ideal forms. Their historical and sacred personages are pure portraits from nature, their very costumes being borrowed from the time of the painter. In consequence of the defective models that presented themselves to the painters, their representations are not wanting in defects: the proportions are faulty, the several parts of the body are meagre and often unhandsome, and even the draperies are characterized by hardness, having an angular appearance and being broken up into many little folds. The accessories on the contrary are depicted with a marvellous exactness and truth to nature, so that one often feels tempted to take a microscope and follow the drawing into its minutest details. Through the invention of John Van Eyck, who was the first to use oil for mixing his colors, a totally different enamel, a fire, and a depth of coloring were attained, such as artists until that time had been able to arrive at only with the greatest trouble and labor. Respecting the masters of this school our information is in some respects still very imperfect, so that to this moment the names of the authors of several of its finest productions have not been positively ascertained.

We will begin with the brothers Hubert and John Van Eyck (1366–1426 and 1370–1441), both of whom received instruction in the art of painting from their father. John was the inventor of oil-painting and is altogether the more celebrated of the two. His chef d'œuvre is the altar-piece in the church of St. John in Ghent, a picture on which there are over 330 heads, each with a different expression. This picture became exceedingly celebrated, and Philip I. of Spain had it copied for himself by Coxcie. John was likewise a portrait and landscape painter, and his pictures are found in various galleries. One of Van Eyck's pupils was Rogier of Bruges, the accounts respecting whom are not free from contradiction, and by whom there are several pictures in Italy. At the same time lived also Hugo Van der Goës and Hans Hemling (not Memmelink, as Van Mander calls him), of whose life little is known, but whose works show him to have been an excellent painter. Many of his pictures are found scattered about in galleries, and there were some of them in Italy even in the middle ages. Of a somewhat different and more secular character were the works of Quintin Messis (1450–1529), known by the name of "the smith of Antwerp," as he was a blacksmith in his youth, which are still met with in many churches and private collections; there were also those of Robert Van der Weyde, who sought to introduce into painting a purer and nobler taste; those of Luke of Leyden, whose best pictures are in Vienna, Berlin, and Munich; and many others. At the beginning of the 16th century, when painting in Italy was gaining its highest triumphs, the artists of the Netherlands endeavored to make themselves familiar with the advances which had there been

made in their art. The consequence was that the native art lost its peculiar character, and borrowed in its place from that of Italy nothing but external forms, movements, and costumes. The coloring, however, long retained its peculiar stamp. The most eminent masters who pursued this course are the following:

John Schoreel (1495–1590), a pupil of James Cornelius, a celebrated painter whose works unfortunately have perished, perfected himself in the school of John of Mabuse and also received instruction from Dürer; he afterwards visited the Holy Land and Jerusalem, seeking out all the places of historical interest, and taking views of them. In Italy, where Schoreel remained for a considerable time, he studied the works of Raphael and his contemporaries; and in consequence he introduced an entirely new taste into the painting of his native land, on which account his countrymen call him "the torch of the painter's art." One of his best pupils was Martin Heemskerk (1498–1574), who likewise visited Italy. After his return he became highly honored in his native land and painted a great deal; but most of his works, including the best, were destroyed at the taking of Harlem by the Spaniards in 1573. Many of the pictures in galleries which go by his name are most probably the work of Egbert Heemskerk.

John of Mabuse (Maubeuge, properly Johann Gossaert, 1498–1562) was born at Maubeuge in Hainault, and studied in Italy. Notwithstanding his more than dubious manner of life and his love of dissipation, he arrived in painting at a very high degree of perfection. He was the first painter that transferred the Italian art to Flanders, and there ventured to introduce figures completely naked into his pictures. His greatest picture was the altar-piece of the church in Middelburg, which was unfortunately destroyed by fire. His works are seldom met with in galleries; yet Vienna and Munich possess some of them. Bernardin of Orley likewise pursued this course; he was one of Raphael's favorite pupils, and the latest investigations have established with tolerable certainty that Raphael's beautiful *Christ bearing the Cross*, known by the name of the *Spasimo di Sicilia*, is in great part from the hand of this artist. From this time onward till the beginning of the 16th century, the masters, with the exception of Francis Porbus, gradually diminished in excellence; and Peter Paul Rubens was the first to awaken art to a new life. This artist, one of the greatest geniuses of his time, was born in the year 1577 in Cologne, whither his father, a lawyer of Antwerp, had betaken himself, in order to escape from the troubles of Brabant. Rubens received a classical education; was then a page, and lastly applied himself to painting, in which he received instructions from Adam Van Oort and Otto Venius. His artistic skill, which soon became very extraordinary, and still more his varied acquirements and agreeable deportment, brought him in contact with the most eminent personages of his time, and led him as ambassador to the court of Philip III. of Spain, whither he was sent by the Duke of Mantua, while he was engaged in Italy, expecially in Venice and Mantua, in studying the old masters. After his return to Italy he came back to his own country, where he lived wholly in the study and practice of his art, until Maria de' Medici

invited him to Paris, for the purpose of adorning with paintings two galleries in the Luxembourg palace; but of these only one was executed, in which he represented the principal events of the queen's life in twenty-four pictures, unhappily in absurd allegories.

Subsequently Rubens again visited Madrid, where he was appointed secretary of state, loaded with high honors, and at length sent to England, to negotiate a peace between England and Spain, a commission which he executed with the greatest discretion. Rubens performed several other diplomatic missions, and afterwards married Helena Forman (1629), who was of such remarkable beauty that he often introduced her into his pictures, sometimes under one form and sometimes under another, now as a shepherdess and again as the queen of heaven, as *e. g.* in the beautiful *Assumption of the Virgin* (*pl.* 18, *fig.* 7). Rubens also frequently painted his own picture, sometimes as a portrait proper, such as is found in the Florence Museum (*fig.* 8), and sometimes in action, as *e. g.* with Helena Forman, as *Shepherd and Shepherdess kissing each other*, a picture preserved in Munich. As for Rubens's style, he took for his models Titian and Paul Veronese; but he failed in attaining to either their noble simplicity, correct drawing, or beautiful forms. His coloring is distinguished by great purity, and by the fact that he laid on the shades close to one another and blended them together with the brush; he never painted over a color, excepting merely that now and then he added azure tints to his lights. His pictures are overloaded with reflexes and reflexions. His composition is remarkable and grand, but his draperies are almost too rich both as regards materials and profusion. Nearly 4,000 pictures are ascribed to Rubens; but although he lived to be sixty-three years old and was very industrious, he could not possibly have performed so much. Most of the pictures were painted by his pupils and assistants, and he retouched them; many too are doubtless only painted by them in his manner or are copies after him. His pupils, Van Thulden, Diepenbeck, Von Hock, Cornelius Schut, Vandyck, Jas. Jordaens, and many others, adhered faithfully to his manner. The most eminent of them was clearly Vandyck (1599–1641) of Herzogenbusch. Rubens soon perceived that Vandyck would be able to surpass him, and accordingly he employed every means to confine the young artist to portraits. After Vandyck had painted two altar-pieces in the church of Savelthem, the celebrated *St. Martin* and a *Holy Family*, which however are no longer extant, he went to Italy to study the works of Titian, Paul Veronese, &c. Here he painted a good deal, but soon returned to his native land, in consequence of the annoyances he was subjected to by the envy of his countrymen. The most brilliant part of Vandyck's career was spent in England, where he painted both historical pieces and portraits. Vandyck (his portrait, painted by himself (*pl.* 17, *fig.* 9), is preserved in the Florence Museum) is the only painter of portraits that can be compared to Titian, and his portrait of *King Charles* is a study for the portrait-painters of all times. Yet Vandyck was great also in historical painting; and there are many pictures by him which deserve to be ranked above those of his master, his drawing being certainly more correct and his coloring more

delicate than that of Rubens. His contemporaries were Jakob Jordaens, Kasper de Crayer, Franz Snyders, &c.

In later times the Flemish school has been illustrated chiefly by de Kayser, Wappers, Bièfve, and Gallait, who form the eminent *Belgian* school of our day, whose great historical paintings are distinguished for their magnificent coloring. Their subjects are drawn chiefly from the history of their country; and their pictures exhibit elegant drawing as well as the noblest harmony of composition.

Nearly related to the Flemish is the Dutch school: at first it assumed precisely the same direction; it then developed itself in a peculiar, often fantastic, and even tasteless manner, and, leaving wholly historical events, it confined itself to the delineation of common life and of natural phenomena, thus passing even entirely into the department of genre, low life, and landscape painting. There is no lack in the Dutch school of distinguished masters in these branches. Eminent among the portrait painters are Miereveld, Francis Hals, Van der Holst, and Keyser; and in a wider sense Paul Rembrandt, Govaert Flink, Ferdinand Bol, &c. The number of masters in genre painting is very considerable; among them are Breughel, Vinkenbooms, Ostade, Teniers, Brower, and others. A somewhat higher flight in genre painting was taken by Terburg, Gerhard Dow, Metzu, Wouverman, and others, who selected their subjects chiefly from the middle and higher classes of society. Francis Van Mieris (1635–81), a native of Delft, pursued the same course. After having been kept for some time to his father's trade, that of a goldsmith, he left it and became a pupil of Gerhard Dow; but he soon left his master and pursued his studies wholly after nature. His genre pictures and portraits of a very small size soon obtained great applause and were sold at high prices (as high as 3,000 florins). He led a pretty loose course of life; and hence some of his pictures have a lascivious character, or at least border closely upon it, as the exceedingly beautiful picture in the Florence Museum of the *Youth with the Drinking-cup*, of which we have given a sketch in *pl.* 18, *fig.* 10. Mieris designed more correctly than his master; his figures have a more noble expression, are full of spirit and freshness, and are more highly finished. There is in Dresden a picture of a man by him, the meshes of whose stockings are so fine that they can be seen only with a magnifying glass. His best works are in Paris, Vienna, and Dresden. His sons, John and William, were likewise good painters. One of Mieris's contemporaries and fellow-pupils was Kaspar Netscher (1639–84), a native of Heidelberg, but who, although a German by birth, belonged to the Dutch school. He wished, after studying also with Terburg, to visit Italy, but got only as far as Bordeaux, where he took a wife; he settled with her in the Hague and painted cabinet pieces and portraits with universal applause. From him we have mostly half figures and conversation pieces, and in almost all of these, as in the picture of the *Guitar-player* (*pl.* 18, *fig.* 11), in the Florence Museum, there is a lady dressed in white velvet, which, as well as stuffs in general, he painted to perfection. Three of his sons devoted themselves to painting.

Adrian Van der Werff (1659–1727) also belonged to the higher department of the Dutch school. He was born in the neighborhood of Rotterdam and was originally designed for a learned profession; but he manifested such great talents for portrait taking that it caused him to turn his attention to painting, and he placed himself under the instructions of Van der Neer. When only in his 17th year, he worked independently, and with so much applause, that the elector palatine gave him employment and afterwards allowed him an annual stipend; the elector was very generous to him in other respects and conferred upon him the rank of knighthood. Accordingly the gallery of that Prince in Düsseldorf displays the finest productions of Van der Werff, who had but little time to work for others. There are some fine pictures by him in Dresden; but they are not to be compared with the Düsseldorf works. No artist has succeeded in obtaining such good prices for his works as Van der Werff. Thus for his picture of *Lot and his Daughters* he was paid 4,200 florins; the *Adoration of the Shepherds* (*fig.* 9), in the Florence Museum, a picture very remarkable both for composition and execution, brought him 4,000 florins; an English nobleman purchased ten pictures from him for 33,000 florins; and his picture of the *Prodigal Son* was bought after the artist's death for 5,500 florins; the *Judgment of Paris*, which went to England, cost 5,000 florins, &c.

Of the painters of battle-pieces belonging to this school we will mention Palamedes, Jean le Duc, and Van der Meulen; of the landscape painters, Cuyp, Hobbema, Wynants, Van der Neer, Ruisdael, Berghem, Everdingen, &c. Marine views were painted by Bakhuysen, Peters, De Vliger, Van der Velde; architectural by Neefs, Steenwijck, De Witte; flowers by Breughel and De Heem; and low life by Adriaenssen, Van Aelst, &c. Dutch artists of recent times distinguish themselves in landscapes, marine views, and animal painting; of these we may mention Koeckoeck, Schelfhout, Schotel, Verboeckhoven, Jansen, and Dreibholz; historical painting on the contrary still remains in a backward state.

6. The English School. During the middle ages the fine arts in England were almost entirely dedicated to the service of religion, and shared in the general European development until the time of the reformation under Henry VIII., in the middle of the 16th century. By this event the existing relations of England with the south of Europe (the chosen seat of fine art cultivation) were rudely disturbed, and the consequence seems to have been that painting and sculpture, too often identified with the old religion in whose cause they had wrought, were treated with indifference and neglect. For nearly two centuries from this time we seek in vain for any distinguished native artist. The names of *Holbein*, *Zuccaro*, *Cornelius Jansen*, *Vandyck*, *Lely*, and *Kneller*, to whom we owe the portraits of the great men of the Tudor and Stuart Dynasties, show that from a foreign source came the talent which met with a ready employment in perpetuating the fair and the brave of their times, for to portraiture the patronage of the great was almost exclusively confined. Charles I. indeed encouraged painting and liberally rewarded its professors; but the distractions of the latter part of his reign, and the succeeding troubles, prevented his efforts for

establishing an English School from meeting with success. In the next century the first name that occurs of any Englishman who had raised himself to eminence as a painter is *Sir James Thornhill*, and he is less remarkable for himself than as the father-in-law of *William Hogarth* (1698–1769), that great man with whom the English school of painting may be said to commence. Unversed in academic rules, and to the last not conspicuous for technical skill in his art, Hogarth derived his inspiration from the nature immediately around him. Sometimes regarded as merely a satirist, a larger object was before him; to amend mankind as well as amuse them was his task. "*The Harlot's Progress*," "*Marriage à la mode*," "*The Rake's Progress*," &c., which have been spread by the graver throughout the world testify to the extent and variety of his powers. These "serious dramas," as they have sometimes been called rather than paintings, deserve the closest study, as the most minute accessories tend to carry out the purpose of the artist. In the words of Charles Lamb, other painters *we look at*, but *we read* Hogarth.

Sir Joshua Reynolds (1723–1792), the great luminary of the English school, was gifted by nature with exquisite taste in his art, which, improved by foreign study and diligent investigation into the true principles of painting, places him at the head of the English school of portraiture. Splendor of coloring and graceful composition are the characteristics of his pictures. He was perhaps most happy in children and female heads; many of them have never been surpassed for truth and purity of effect. The few historical pictures he painted were not calculated to increase his fame. As first President of the Royal Academy established in 1768, Reynolds exerted great influence in the progress of the arts, and his lectures or discourses on painting, delivered before that body, will long perpetuate his name as a classic and enlightened writer on art. Among the first academicians we find the names of West, Wilson, Gainsborough, and Barry, who all deserve separate mention.

Benjamin West (1738–1820) was born in Pennsylvania, and after studying his art in Italy, he settled in London in 1763. He soon attracted the attention of George III., and chiefly through his patronage was enabled to execute the numerous historical works for which he has been celebrated. Posterity has failed to confirm the judgment of his contemporaries. With one single exception, the *Death of Wolfe*, in which he first ventured to break through the old conventionalities of treatment, his works are viewed with indifference, and their academical correctness is not sufficient to rescue them from the charge of insipidity and feebleness. West succeeded Reynolds and was the second President of the Royal Academy.

In *Richard Wilson* (1714–1782) the English for the first time had a landscape painter who could be compared with the great old masters. His style was formed by a study of Italian nature, and met with little encouragement from the patrons of his day; his career was an unhappy one, but the pictures which he painted, to provide the mere necessaries of life, are now purchased at enormous prices as the ornaments of the choicest galleries.

Thomas Gainsborough (1727–1788) was a truly English painter; he excelled in portraits as well as in picturesque delineations of English landscape; in them his freedom of handling, force, and vigor of touch, have never been excelled.

James Barry (1741–1806), an Irishman of great talent, who scorned the common way to fame and fortune, devoted himself to the higher historical branch of his art. He is well known by his great series of pictures illustrating *the Culture and Progress of Human Knowledge*, painted for the Society for the Encouragement of the Arts, which was declared at the time to be the greatest work north of the Alps.

John Opie (1761–1807), the rough and energetic self-taught portrait painter, *George Romney* (1734–1802), the temporary rival of Reynolds, and *James Northcote* (1746–1831), the careful and studious illustrator of Shakspeare and English history, may be mentioned as the chief artists of this generation, though our limits forbid a lengthened notice. With the present century commences the fame of Sir Thomas Lawrence.

Sir Thomas Lawrence (1770–1830), the worthy successor of Reynolds in the Presidency of the Royal Academy, is the head of the English school of portrait painting. Favored by fortune with the patronage of the great, and gifted by nature with a taste and manner of the highest elegance, Lawrence is the model of a court painter; and if he does injustice to his powers in too many instances, a number of his portraits (as that of Pope Pius VII.) will remain to testify to the brilliancy of his coloring, and the refinement of his execution.

Since his time the number of artists has increased so rapidly in England, that we can only briefly allude to the more conspicuous of them. *Sir David Wilkie* is perhaps the most widely known of any English artist. Inferior to Hogarth in depth of feeling and moral purpose, his unrivalled sense of the humorous, and academic skill in painting, make him world-renowned. *Leslie* and *Mulready* are distinguished in the same line of art, the representation of domestic and familiar scenes. In landscape, the peculiar glory of English art, the names of *Turner*, *Callcott*, *Stanfield*, *Roberts*, and a host of others, are conspicuous, each for his varied and peculiar excellence. In historical painting, *Etty*, *Eastlake*, and *Maclise* are the most distinguished. As a painter of animal life, *Edwin Landseer* has surpassed all previous artists. As regards drawing, color, and characteristic expression, his finest works are miracles of art. Since the accession of Queen Victoria, efforts have been made on the part of the government for the patronage of high historical art. The decorations of the new palace at Westminster have afforded an ample field for the exercise of talent, and we now see the most rising painters of the English school for the first time creating a school of fresco painting, the effect of which must be most salutary and ennobling to art.

7. An American School of Art cannot as yet be said to exist, owing to the extreme youth of the country, and the enormous tasks in material improvement that had, and in part still remain to be performed, before an adequate patronage can be extended to the Fine Arts. It is, however,

worthy of notice that, in spite of the trifling encouragement American artists as yet could hope to meet with, a number of talented men have devoted themselves to the study of sculpture and painting, and have secured for themselves a good share of the admiration of connoisseurs. Thus the great Thorwaldsen named among the foremost sculptors of the age two Americans, *Hiram Powers* and *George Crawford:* the former as rivalling himself in the boldness and purity of his busts; the latter as deserving the greatest credit for the harmony of his groups and the ease of his drapery. Among the painters belonging to America *Washington Alston* and *Thomas Cole* deserve to be especially mentioned. Much has been done in late years towards making art popular by the establishment of art-unions in various cities of the United States, whose purpose it is to encourage artists by purchasing their works, and distributing them among their members after exhibiting them for a season. These art-unions may be regarded as creating the germs of a future American school; and when we consider the immense field open for the development of an original school of art, in the bold and picturesque conformation of the country; in the original features of American life, commercial, rural, and political; and in the very progress of improvement in the various pursuits that engross the attention of the people, and whose different stages wait to be recorded by the artist's pencil or chisel; we consider ourselves justified in expressing the view that one day the American school of art will reach a high point of excellence, and will command the respect of the world as perfectly as American skill and energy have already done in every utilitarian branch upon which they have as yet been concentrated. But that is a high eminence to climb, and it is to be hoped that the contenders for the prize may not be misled by excess of praise to sit down in self-complacency when their work is only half done, or their natural talents only half developed. They should also bear in mind that, while they naturally have to learn a great deal in points of technicalities and accuracy of drawing from European masters, ancient and modern, a servile adoption of the manner of any one master or school, however sublime, will retard their progress instead of speeding it. If their progress equal their beginning in zeal, if they preserve their own freshness and originality of conception while enlarging their æsthetic feelings by a close study of whatever is excellent in foreign schools of art, and if their fellow-citizens extend to them a judicious patronage, thus enabling them to follow the glorious path they are led into by their own inspiration, then may we hope at no distant day to see their efforts result in a respectable and original American School of Art.

3. Theory of the Art of Drawing.

The art of drawing represents the *visible form of bodies on a plane.* This representation is called the *drawing* of the bodies.

The *materials* employed in the art of drawing are: first, any smooth surface, as, for instance, that of paper, parchment, canvas, ivory, stone,

&c., called the *plane of the picture;* secondly, any more or less colored substance, as, for instance, lead-pencil, chalk, Indian ink, common ink, &c.

By means of the latter we make on the former either mere lines, answering to the *outlines* of the body to be represented, the aggregate of which is called the *contour;* or we draw also within the contour various degrees of shades, corresponding with the light and shade of the body, which is called the *shading.* The shading is performed in several manners, from which the work is denominated a drawing in *hatching*, in *graining*, in *Indian ink*, &c.

A more essential difference of the graphic manner arises from the principle which governs it. If the graphic representation of an object is founded upon *optical laws*, *i. e.* upon the real perception of an object from one point in space, it is then called a *natural drawing* of the object; for such a drawing, in being looked at from a proper position and distance, strikes the eye in the same way as the object itself viewed from the same point. Such a natural drawing is also called a *perspective drawing* or a *perspective projection*, from the optical laws applied in its construction, in opposition to the *geometrical projection* of the same object, made on geometrical laws, which are reducible to an imaginary perception from an infinite distance, by means of parallel rays of sight. Natural drawing alone belongs to the Fine Arts. In closely comparing the appearance of an object in a natural drawing with its real configuration, we readily perceive that it essentially differs from a geometrical projection of the same; that the former is but an optical phenomenon representing the image of the object in the same way as it falls, through the pupil, upon the retina of the eye.

It follows from what has just been said that the conditions required for producing a natural drawing are: 1. The exact knowledge of the real shape of the object; 2. The knowledge and application of its optical appearance upon a plane. The former is taught by *Morphology* or the *doctrine of forms*, the latter by the *Art of Perspective.* The two combined are the basis of the art of drawing; while the doctrine of illumination (of shades and shadows) teaches the distribution of the degrees of light on and around the object.

A. Morphology, or Doctrine of Forms.

The objects of the art of drawing are the visible bodies and phenomena of nature and of social life. It is the duty of the artist to render himself capable of representing them with exactness in a natural drawing. He must, therefore, study those portions of architecture, of botany, zoology, of the theory of clouds and of the movements of water, which treat in general of the *forms* of their objects. He must, moreover, endeavor to find in nature a certain *model* for each single object which he is about to draw, with the view of practising its several parts in preparatory essays, and of developing on it the peculiar individual character which he intends representing in his drawing. Such extensive preparatory studies cannot be enjoined upon a mere amateur of the art. Yet even he ought never to draw anything, or even copy any drawing, for which he cannot procure

a corresponding object in nature as a model, whose smallest parts he might compare with their representation upon a plane. Drawing from nature is most efficient in forming the eye and hand, and must be first practised, even by a dilettante, from real, sharply defined bodies, beginning with geometrical figures, proceeding through the simplest products of mechanical arts, to plants, animals, &c. It is only after this sort of drawing, by which the student has enabled himself to become, so to speak, penetrated by a double perception of the objects drawn, that the question about *art* can arise. The designer must have become able to represent to his mind all objects of a drawing as they actually exist, *i. e.* to see the complex of all lines as if they were projected from the plane of the picture into space while, at the same time, he must be able to see in his mind's eye every real object as if it were depicted on a plane surface. After this attainment only can the draughtsman be said to be prepared to enter into the sanctuary of art; nay, not till then will he be able to produce a *correct copy* of a drawing.

In order to obtain a precise knowledge of forms or shapes as they exist in space, the theory of lines, angles, surfaces, volumes, as treated in geometry, must be thoroughly studied. After this only can we attempt to draw the simplest bodies of nature. This elementary knowledge is indispensably necessary for this reason: it stamps on our mind the sense of definiteness of form, whence the perception of all the characteristics of the various configurations of visible objects can be safely developed, since geometrical figures are their absolute constituent parts. The truth of this is evident as regards crystals, the simple products of mechanical arts, of architecture, &c. The objects of nature will be treated of, in this respect, in the sequel of this statement. Meanwhile it will be useful to examine the auxiliary lines in the figures given in explanation of the subject (*pl.* 19, *figs.* 7, 8, 13–16; *pl.* 20, *figs.* 13, 14, 20; *pl.* 21, *figs.* 12–16).

Being obliged to restrict ourselves to mere hints, we propose to give a short outline of *universal* morphology, of *anatomy* as part of special morphology; and, after having referred to the essential points of *perspective*, to treat of the *delineation of the human body* as a specimen of the application of morphology and perspective combined.

1. Universal Morphology. *a. The Straight Line.* Of all possible directions in space the most definite and absolutely steady are two: *the vertical line* (*pl.* 19, *fig.* 45 DP) and *the horizontal line* (*fig.* 42 *cd*). They are called the *chief directions.* The numberless other directions are more or less *oblique* (*fig.* 45 *m*D, *n*D, *t*D, *r*D, &c.), and can be determined only by their respective relations to the two chief directions. The latter indicate either by themselves the position of an object (*pl.* 19, *figs.* 13, 14, 16), or they assist in determining it (as the auxiliary lines in *figs.* 1, 2, 41–45). The vertical line is characteristic of *standing* and *striving upwards*, the horizontal of *reclining* and *resting*.

b. The Angle. Of all possible angles the *right angle* is the only definite invariable one, and serves therefore as the standard in the determination of all other, or *oblique angles.* The latter being either *acute* or *obtuse*, *i. e.*

smaller or larger than a right angle, are determined by their respective proportions to the standard (*pl.* 20, *fig.* 4 *abq* right, *pgq* obtuse angle; *fig.* 6 *abq* right, *pgq* acute angle). The *position* of a right angle can vary; it is called *normal* when its sides are in the *chief directions*, and *oblique* when its sides are oblique lines; in the latter case its position is determined by auxiliary lines having the chief directions.

c. Rectilinear Figures. Of rectilinear figures *the square* is the most regular, being formed by four right angles and four sides of equal length (*pl.* 16, *fig.* 40 *bwxy*). Being the most accurately determined figure it serves for the determination of others. Its position, like that of the right angle, can be normal or oblique.

Next to the square in simplicity is the *rectangle*, differing from the former only in being inclosed by two pairs of parallels of unequal length (*pl.* 19, the boundaries of *figs.* 41–45.) The proportion of form, *i. e.* of the height to the breadth of a rectangle, is most simply determined by the draughtsman by dividing it into squares (*pl.* 20, *figs.* 13, 14; *pl.* 21, *figs.* 12–15). The normal position of a rectangle is either the *reclining* (reversed) (*pl.* 19, *figs.* 41, 42), or the *standing* (erect) (*figs.* 43, 44). All other positions are oblique.

With regard to definiteness of form to the eye, the next figure to be considered is the *equilateral triangle*, and after it the *isosceles* in its varieties (steeple, roof, or gable-shape) arising from different proportions between the height and the base. Then follow the *regular hexagon*, *octagon*, and other *polygons*, which, like the irregular ones, are determined either by means of the above enumerated simple figures, or by division or integration (complementing).

d. Curves (or *curved lines*) are determined as to their form by examining whether they be of *equal* curvature throughout or *not*. The *circle* is the standard of the former. Of the *unequally* curved lines the *rule of their curvature* must be determined, and the places of *greatest* and *relatively inferior* curvature found. This determines the character of a curve as an *ellipse*, *parabola*, *cycloid*, *spiral*, &c. It is further to be examined in which part or division there is a *concavity* or a *convexity*, and whether either of these is constant or whether concavity *alternates* with convexity as in *wave* and *serpent-lines*, and the outlines of a *nose*, *mouth*, &c. In the latter case the *points of recurvature*, or the points where concave curves pass into convex ones, are to be accurately observed. Curves of a freer sweep, as for instance the profile lines of organic formation, are determined by comparison with those whose curvature is reducible to geometrical laws.

Mathematics teach the precise formation of the geometrical curves. But we may obtain an immediate knowledge of their form as well as of that of the organic curves (of mountains, clouds, plants, animals, &c.) in the following manner. We apply the enumerated rectilinear auxiliary figures either between two points of recurvature or the terminal points of a curve, or at one point on the convex side of a curve. In the former case the determining or auxiliary lines form *chords*, in the latter *tangents*, vertical or horizontal ones being most available. We then carefully observe the point of the

greatest divergence of the curve from the chord, the proportion of the distance of this point to the length of the chord, and the precise direction of the latter. Or if we employ tangents we measure the various distances on both sides of the point of contact between the curved line and the straight auxiliary. These few indications will suffice to show the ample field of observation and study afforded by the endless variety of curves that occur in the great domain of nature.

e. Curvilinear Figures are either in themselves sufficiently definite for immediate conception by our mind (the simplest being the circle, next the ellipse, and then the oval), or they require the application of auxiliary lines to determine their forms, and are then to be resolved into their various curves, the divergence of each from a straight line being determined as before indicated.

f. Geometrical Bodies. The cube, parallelopipedon, tetrahedron, the prism in its various forms, the pyramid, cone, cylinder, sphere, ellipsoid, the egg, and the various mineral crystallizations, constitute a series of forms from the most definite and easily determinable to the indefinite and difficult, similar to that of lines and plane figures before alluded to. Our limited space forbids a detailed consideration of these forms and of the manner in which those whose forms are definite are used in determining the conformation of the irregular ones. But we urgently recommend a minute study of these forms, inasmuch as they not only exert the greatest influence upon our more or less correct appreciation of the plastic conformations in nature, but afford us constructive auxiliary bodies to facilitate our transferring the bodies produced by nature into a perspective projection or natural drawing.

With a view of promoting the study of forms, we add the following general observations on *general outlines*, *general forms*, *symmetry*, and *skeleton of axes*.

Most of the forms of natural objects are continuous deviations from such geometrical figures as form their basis, and which, when imagined around or in a natural body, can be called in the drawing its *general outline*. To find this general outline in any object is the first condition for the determination of its form, and the principal auxiliary in its correct representation. It is found by trying to circumscribe the object as closely as possible with straight lines or geometrical curves, in such a manner that, if need be, we either complete some of its parts by auxiliaries (*pl.* 19, *fig.* 20), or cut off some of its protuberances (*pl.* 20, *figs.* 3–6, 13–15), or inclose them in suitable auxiliaries (*pl.* 19, *figs.* 13, 14; *pl.* 20, *figs.* 7, 8). Principal parts of whole figures can be treated in the same manner (the arms, *pl.* 21, *figs.* 14, 15; the skull, *pl.* 20, *figs.* 4, 5, 7, 8). Even geometrical figures can be thus reduced to their simple fundamental forms; for instance, a regular octagon can be reduced to a square by prolonging its horizontal and vertical sides; a regular hexagon to an equilateral triangle by prolonging three of its sides; a trapezium to a triangle by prolonging its non-parallel sides (*pl.* 19, *fig.* 45, cap and base of the pilaster in the building on the left). By circumscription the square is shown to be the basis of the circle (*pl.* 20, *fig.* 8, square and circle over the line 1); the rectangle that of the ellipsis

and of the oval (*pl.* 20, *fig.* 7), the proportion of length and breadth remaining unaltered. In a similar manner the general outline of the human head in the front view is an oval, but in other views an oval-like general form (*pl.* 20, *figs.* 1, 2, 7, 8; *pl.* 21, *figs.* 6–11). The same proceeding holds good with regard to bodies. Thus, by producing the corners of the capital and of the pedestal of the corner pilaster of the edifice on the left (*pl.* 19, *fig.* 45), we obtain pyramids, and by lines connecting the corners of the steps on the obelisk (ibidem, on the right), and producing them until they intersect each other, we complete the general form of a four-sided pyramid. It is also easily perceptible that the cube is the general form of the sphere; the parallelopipedon, of the ellipsoid; the egg, of the human head.

By drawing through the middle of a figure a right line in the direction of its length, we obtain its *longitudinal axis;* and by doing the same perpendicularly to that axis, through the greatest breadth of the figure, we find its *lateral axis.* If the figure be divided by either of its axes into two equal but opposite parts, the figure is said to possess *symmetry*, and those parts are called *symmetrical opposite* sides. All regular geometrical figures, including the rectangle, the isosceles triangle, and the isosceles parallel-trapezium, are symmetrical; and so also the ellipse, the oval, &c. (*pl.* 19, *figs.* 13, 14, 16). A figure with a *centre*, from which it can be divided into three or more equal opposite parts by as many lines, is said to possess a *stellar* or *central symmetry.* Such is the case with all regular geometrical figures, with all cross and star flowers (cruciferæ, asters), &c. The symmetrical opposites in symmetrical bodies are similarly disposed round either a *central axis*, as in the prism, pyramid, cylinder, cone, and egg (*pl.* 19, *fig.* 45, obelisk), or round a *centre* (as in the sphere, the regular geometrical bodies, and crystal forms), or on both sides of an imaginary *plane-axis*, as in most animals, the human body, in regular edifices, &c. &c. The inquiry into the symmetry of a figure, and the finding of its axis of symmetry, or plane-axis, is one of the essential means towards the knowledge of its conformation. We must observe that in most organic forms (plants, flowers, &c.), especially in animals, the equal position of the symmetrical opposites is abolished, and the axes of symmetry, which have originally been straight, have become curved lines, and that it is owing precisely to this deviation from exact symmetry that the organic bodies are endowed with the charm of life, and with movement. Constant symmetry as well as the degree of deviation from it, must be assiduously studied, in order that the designer may be able to conceive and to express movement. This is a point of the greatest importance for the artist. Scarcely less important is the fact, that axes or mid-lines may be found also in less strictly symmetrical organic forms and in their parts (thus in plants, animals, especially in the human body), about which axes the mass or matter of the form itself is located in a certain statical equipoise, and around which the most manifold forms are disposed in a harmonious arrangement. To observe all this, to feel it out as it were from the laws of nature, is the mission of the artist.

If the natural body consist of several essential parts which issue from the principal form like branches (as the branches and boughs from the stem of a

tree, or the limbs from the trunk of an animal), then the axis of the principal form constitutes, in connexion with the axes of the branches or limbs, a system or *skeleton of axes.* To discover the position and the proportion of this system, to define and to employ them as the foundation of a design, is the first, must be the chief problem of the artist, in order that he may recognise, comprehend, and vividly represent the general as well as the individual form of a natural body.

2. Special Morphology. Anatomy. Since our limits do not permit us to enter upon a detailed elucidation of all the various modes by which the tenets of universal morphology are applied to the representation of different objects, as, for instance, by the painter of buildings to the various styles of architecture, by the painter of landscapes to the manifold diversity of plants and of terrestrial scenery, we shall restrict our considerations to a single but most interesting department of morphology, *i. e.* to *anatomy*, which is indispensable to the designer of the human figure.

As the trunk of a tree, with its ramifications, forms the plastic framework for the masses of foliage, blossoms, and fruit, so is the *skeleton* or the complex of the bones, the frame of the whole human body, the supporter of the mass of flesh that surrounds it. The study of the osseous system, of the proportions of its system of axes, as well as of the form of the several bones, of their symmetrical and statical arrangement into a wonderful machinery of articulated or organic mechanism, constitutes the first part of the anatomical studies of the artist. What has been said on this subject in the division of this work devoted to Anthropology will suffice as a guide for the artist. We will in this place consider the muscular system with a special view to artistical representation.

The thorough understanding of the muscular structure is indispensably necessary to the designer of the human figure, especially of the nude form, which is the complete mirror of spiritual man. Without this knowledge it is impossible to represent in drawing, even from a living model, the play of the muscles that would manifest itself in the peculiar movement and in the individual expression of the figure, as conceived in the idea of the artist. Even a mere copyist of an already drawn or painted human figure, if deficient in such knowledge, would be at a loss to know all that the designer or painter of his original intended to express by his particular clearer or darker touches, by his emerging and again vanishing lines (compare *pl.* 21, *figs.* 12–15, 18–21); he would not be able to distinguish the essential single traits from such as might be unessential, or even merely accidental or owing to a faulty impression.

In naming, locating, and explaining those muscles which are situated on the surface of the body under the skin, and which are therefore conspicuous by their play, by their rising or subsiding, in consequence of the various movements of man, and consequently of importance for the artist, we shall refer to *pl.* 20, *figs.* 15, 16, representing the anterior and posterior views of man's body divested of its cutaneous integuments and blood-vessels.

In the front view of the figure (*fig.* 15) we have presented to us the following muscles: 1. *Musculus frontalis.* It elevates the eyebrows, the

inner corners of the eye, and the skin of the nose, and it wrinkles the skin of the forehead. 2. *M. temporalis*, raises the lower jaw. 3. *M. zygomaticus*, draws back the corner of the mouth towards the ear and the cheek-bone. 4. *Levator labii superioris*, raises the upper lip. 5. *Buccinator*, draws the cheeks and the lips towards the grinders. 6. *Masseter*, raises the lower jaw. 7. *Orbicularis labiorum*, draws the lips together. 8. *Sterno-cleido-mastoideus*, springs from the upper part of the breast-bone and collar-bone, and ends in the mastoid process near the ear. It bends the head forwards. 9. *Trapezius*, springs from the dorsal vertebræ and from the back of the head, and ends in the collar-bone. It draws back the head and the shoulder-blades. 10. *Sterno-hyoideus*, ascends from the breast-bone to the hyoid bone, and draws the hyoid bone downwards. 11. *Omo-hyoideus*, springs from the upper margin of the shoulder blade, and is inserted into the hyoid bone, which it draws downwards. 12. A small portion of the pectoral muscle (see 15). 13. *Deltoideus*, springs from the bone of the shoulder, and descends to the middle of the upper arm. It draws the arm outwards and upwards. 14. *Latissimus dorsi*, springs from the lower dorsal and the lumbar vertebræ, the sacrum, and the coccyx, passes obliquely forwards, and is attached partly to the outer ends of the four lowest ribs, and partly by means of a tendon to the humeral bone. It can draw the arms downwards and the ribs upwards. 15. *Pectoralis major*. Its greater portion springs from the outer surface of the breast-bone and the cartilages of the six upper ribs. 16. Its smaller portion springs from the sternal end of the collar-bone, and ends in the outer side of the upper part of the humerus. It draws the arm strongly forwards against the breast, or, if the arm be made fast, it draws the breast-bone towards the arm. 16. *Serratus anticus major*, springs from a number of digitations of the ribs, extending from the second to the ninth, then contracts, and is attached behind to the shoulder-blade, which it can draw forwards. When the arm is fastened it helps to enlarge the cavity of the breast. 17. *Brachialis*, is for the most part covered by No. 18, arises from the outer surface of the middle of the humerus, spreads over the outside of the elbow-joint, and is attached to the upper end of the ulna. It bends the arm. 18. *Biceps brachii*. One of its heads springs from the capsule of the shoulder-joint, and the other from the coracoid process of the shoulder-blade; it passes down the humerus, and ends at the elbow-joint behind the tubercle of the radius. It helps to bend the fore-arm, and at the same time turns it somewhat outwards. 19. *Linea alba*, goes from the scyphoid cartilage down to the pubes, and is formed by the union of the tendons of some of the abdominal muscles from both sides. 20. *Rectus abdominis*, ascends from the pubes to the lower costal cartilages and the scyphoid process. It is interrupted in its course by some small tendinous intersections which cross the muscle. It can bend the body forwards. 22. The navel. 23. *Obliquus externus*, springs from the lowermost ribs, and from the haunch-bone; it passes in a broad, thin tendon (21) over the preceding muscles, and is attached to the linea alba. With the other abdominal muscles it effects expiration, and can turn the breast to one side. 24. *Pronator teres*, springs from the inner condyle of the humerus,

descends obliquely, and is attached to the middle of the radius. It turns the hand forwards. 25. *Flexor carpi radialis*, springs from the same place with the preceding muscle, descends along the fore-arm, and is attached to the metacarpal bone of the index finger. It flexes the hand. 24. *Supinator longus*, descends from the outer condyle of the humerus, and is attached to the lower end of the radius on the outside. It turns the hand outwards. 27. *Abductor pollicis longus*, springs from the outside of the fore-arm, passes round the lower end of the radius, and is attached to the large multangular bone, and to the metacarpal bone of the thumb. It stretches out the thumb and draws it from the hand. 28. *Palmaris longus*, arises along with No. 24, and runs along the inside of the arm to the palm, where its thin tendons are lost in the palmar fascia. It contributes to flex the hand. 29. *Flexor carpi ulnaris*, springs from the inner condyle of the humerus, descends along the ulna, and ends in the pisiform bone of the wrist. It helps to flex the hand. The flexors (30, 31) of the fingers pass underneath a strong band (32), which passes from the unciform bone over the scaphoid bone and the great multangular bone, to the palm, and terminates at the finger-joints. 33. *Sartorius*, springs from the anterior spinous process of the ilium, and runs obliquely inwards (37) to the upper end of the tibia, where it is inserted. It serves to cross the legs. 34. *Pyramidalis*, springs from the pubes, and ascends to the linea alba, to which it is attached. It co-operates with the other abdominal muscles. 35. *Tensor fasciæ latæ*, springs from the anterior spinous processes of the ilium, and runs below the crural ligament which surrounds the muscles of the thigh. It loses itself in this ligament, and stretches it. 36. *Gracilis*, springs from the ischium, passes down one side of the thigh, and is attached to the upper part of the tibia. It flexes the thigh and draws it somewhat inwards. 38. *Rectus femoris*, springs from the front of the ilium, and passes along 41 to the upper end of the tibia. It stretches out the lower part of the leg. 39, 42, 44. *Vastus internus*, springs from the inside of the thigh, and agrees in its course and effect with 40. 40. *Vastus externus*, springs from the outside of the femoral bone, and descends, turning somewhat round in front (43) to the tibia. It helps to stretch out the lower part of the leg. 45. *Gastro-cnemius*, springs with two heads from the lower end of the thigh-bone, and passes into a thick tendon, the tendon of Achilles, which is inserted into the heel-bone. It stretches out the foot. 46. *Peronæus longus*, springs from the fibula and tibia, and ends in the sole of the foot. It extends the foot and turns it outwards. 47. *Tibialis anticus*, springs from the outer surface of the tibia, passes downwards, turns inwards about the foot, and ends partly in the great sphenoid bone and partly in the first metatarsal bone. It bends the foot. 48. *Extensor digitorum longus* spreads near the preceding, passes downwards, and divides into four tendons, which are attached to the second and third joints of the four smaller toes. It extends the four toes. 49. *Soleus*, springs under No. 45, from the posterior surface of the fibula, and ends in the tendo Achillis. 50. *Flexor digitorum longus*, springs from the posterior surface of the tibia, descends behind the inner ankle-bone to the sole of the foot, and then

divides into four tendons, extending to the four small toes, which it bends.

In the front view (*pl.* 20, *fig.* 16) we have the following principal muscles. 1. *Levator scapulæ*, which is partly covered by No. 3, as it springs from the upper cervical vertebra and descends to the upper corner of the shoulder-blade. It serves to elevate the shoulder-blade. 2. *Deltoideus* (*fig.* 15, *No.* 13). 3. *Trapezius* (*fig.* 15, *No.* 9). 4, 5. *Infraspinatus*, springs from the great fossa of the shoulder-blade, and is attached to the upper end of the humeral bone. It turns the arm upwards. 6, 8. *Teres major*, arises from the lower angle of the shoulder-blade and is attached to the humerus on the inside. It turns the arm inwards. 7. *Latissimus dorsi* (*fig.* 15, *No.* 14). 9. *Triceps brachii.* One of its heads springs from the front end of the shoulder-blade and the other two from the humeral bone; it covers the posterior surface of this bone, and is attached to the ulna by a broad tendon. It serves to extend the fore-arm. 10. An offset from No. 7 to the spines of the lumbar vertebræ. 11. *Anconæus parvus*, springs from the lower end of the humerus and ends in the ulna. It supports the extensor muscles of the fore-arm. 12. *Extensor digitorum communis*, springs from the humerus, passes down the hinder surface of the fore-arm, and is divided into four tendons, which are attached to the second and third joints of the fingers. It extends the fingers. 13. *Extensor carpi ulnaris*, arises along with the preceding, is attached to the fifth metacarpal bone, and assists to extend the hand. 14. *Flexor carpi ulnaris* (*fig.* 15, *No.* 25). 15, 16. *Glutæus medius*, springs from the outer surface of the ilium and is attached to the upper end of the thigh-bone. It works along with the following one, by which the greater part of it is covered. 17. *Glutæus maximus*, springs from the posterior surface of the os ilii, from the sacrum and from the coccyx, and is attached to the posterior surface of the femoral bone. It serves to extend the thigh. 18, 19. *Vastus externus* (*fig.* 15, *No.* 40). 20. *Semitendinosus*, springs from the ischium and descends to the tibia, to the upper end of which it is attached. It flexes the thigh. 21. *Biceps femoris.* One of its heads springs from the ischium, and the other from the middle part of the posterior surface of the femur, and it is attached to the head of the fibula. It flexes the lower part of the leg. 22. *Adductor magnus*, springs from the ischium and the pubes and terminates in part on the middle of the inside of the thigh-bone, while the rest of it descends to the lower end of that bone. It draws the thigh inwards. 23. *Gastro-cnemius* (*fig.* 13, *No.* 45). 24. *Soleus* (*fig.* 15, *No.* 49). 25. *Extensor digitorum longus* (*fig.* 15, *No.* 48). *Flexor digitorum longus* (*fig.* 15, *No.* 50).

In closing this enumeration we must not omit to remark that the muscles here named are by no means all that are found in the human body, but that those only have been selected the play of which during the motions of the body is particularly observable from the surface.

It is of great importance to observe that the enumerated muscles stand in manifold relations to one another as regards their conspicuousness on the surface of the human body. Some muscles are always conspicuous; some become manifest and sharply defined only at certain movements of the whole body

or of its single parts, thus causing others that are near them to vanish more or less; others, again, are never prominent. On the bodies of children and young persons certain muscles, not being yet fully developed, are less visible than on older people. The same is the case with female forms. In these, as in general in fat or obese human bodies, the interstices between the muscles are more or less filled up with adipose substance, which overlies in some spots the muscles themselves. In consequence of this the muscular frame becomes less conspicuous than in bodies whose muscles are freed from that incumbrance by dint of powerful movement and active exercise, their muscles being immediately under the skin. All these, and similar modifications and relations, can be studied and appreciated only by an immediate and assiduous contemplation of living models or of the best statuary of antiquity, as well as of that of such eminent artists as *Thorwaldsen*, *Rauch*, *Schwanthaler*, &c., or of plaster-casts of such works. In drawing these we again must take heed not to be carried away by the desire of showing our knowledge of anatomy by too strong and explicit an indication of the muscles, or we shall be in danger of representing flayed figures (*pl.* 20, *figs.* 16, 15), rather than fine-limbed and powerful ones (*pl.* 20, *figs.* 13, 14; *pl.* 21, *figs.* 12–15, 18). In the latter the play of muscles, although they are strong, is tempered by thin layers of fat and by the cutaneous integument being stretched over them, so that their prominence and subsidence are mutually compensated, and a pleasing plastic equipoise is thus established.

B. Pictorial Perspective.

After having made himself thoroughly acquainted with the actual forms of objects, the draughtsman has yet to acquire a two-fold knowledge: viz. 1. That of the *appearance* to the eye at one point of view of the actual form of objects extending in space in three directions, the three dimensions of bodies; and 2. That of the manner of fixing this appearance as a drawing on the *plane of a picture*, *i. e.* of reducing the appearance of the *three* dimensions of bodies to the *two* dimensions of a plane.

Both these points are taught by *Perspective*. Its principles have already been developed in the mathematical part of this work (vol. i. p. 50), but this is a suitable place to add a few remarks on its application to the art of drawing.

In drawing from nature, a *natural drawing* originates in the mind of the delineator by his imagining a transparent plane, *e. g.* a pane of glass placed between his eye (*the point of view*) and the object to be drawn. This transparent plane represents the *plane of projection*. By keeping his eye steadily on this plane in one direction the draughtsman will fix upon it, in his mind's eye, the true copy of the object behind it, by imagining points and lines drawn on the transparent plane in such a manner as to cover precisely the outlines of the real object. This imagined true copy on the transparent plane is the *image* or the *perspective projection*. This image has to be transferred by real, visible lines to the plane of the picture in order to obtain a *natural outline* of the object. Such an out-

line, filled up with exact imitations of the colors of the object and their delicate shades, and placed in the precise position of the imagined transparent plane, will convey to the eye from the old point of view the impression of seeing the object itself, though it be entirely covered by the picture or taken away.

The pupil in the art of drawing must by practice acquire the faculty of beholding all visible objects before which he assumes a fixed point of view as if they were already drawn on a transparent plane; and conversely, of imagining a natural drawing as a transparent plane behind which the objects of the drawing appear as if existing in reality. Both these accomplishments must be aimed at from the very beginning of instruction in drawing, in order to insure a thorough understanding on the part of the pupil.

When we view various natural objects as if seen through a transparent plane, and fixed upon it as described, we can by mere ocular perception recognise the following laws, which are also susceptible of mathematical demonstration.

1. Lines, angles, and figures of solid bodies (*i. e.* of objects of threefold extension in space), *parallel* to the transparent plane, *preserve in the image their real position and form;* or, more explicitly, such *lines* retain their real *direction;* such *angles* their real *size;* and such *figures* their real *form* and *position.* All lines, angles, and figures *not parallel* to the transparent plane exhibit in the image an *altered direction and position.* This will be more clearly understood after a comparison (*pl.* 19, *figs.* 43, 44) of the perspective niches in the backgrounds with those on the sides; and (*fig.* 45) of the façade in the centre of the background and of its details with the perspective forms of the similar fronts on the left side in the foreground; and finally of the front and side faces of a perspective drawing of a double cross (*fig.* 40).

2. Lines and figures on a body, or the body itself, *appear smaller* on the transparent plane *in proportion to their increased distance* behind the same. This *perspective reduction* is illustrated (*pl.* 19, *fig.* 40) by the different appearance of the projecting and receding lines, squares, and cubes, which in reality are all alike; and is still more prominent (*fig.* 45) in the perspective forms of the buildings in the background as compared with those of the foreground, whose real dimensions are equal; as well as in the divisions of the floors (*figs.* 41, 42), which in reality are of the same size.

3. All lines on a body *parallel to each other*, but not to the transparent plane, from which they *recede* either at right angles or obliquely, *converge* in the image to one point, the *vanishing point*, if sufficiently extended. Thus all the lines converging to the point *s* (*fig.* 40) are in reality *parallel to each other*, receding at *right angles* from the transparent plane. The same is the case with the lines converging in the point P (*fig.* 45), whilst those converging in D2, being parallel to each other, recede *obliquely* from the transparent plane.

5. A *line in space* drawn from the *eye* of the draughtsman towards the transparent plane, and *parallel* to a number of parallel lines on the object,

will intersect the transparent plane in the vanishing-point of the image of the parallel lines on the object. Vanishing-points determined by such imaginary lines in space are shown at *p* and *s* (*fig.* 40); at *e* (*figs.* 41, 42); and at P and D2 (*fig.* 45). If such a line in space intersect the transparent plane *at right angles*, the vanishing-point coincides with the *point of sight* (*figs.* 40, *s*; 41, *e*; 42, *e*; 45, P), and the horizontal line passing through this point is the *horizon* of the image. If the line in space intersect the transparent plane *at an angle of* 45° *or less* and at the same time be horizontal, the point of intersection is called *the point of distance* of the image, and lies in the horizon at a distance (right or left) from the point of sight equal to the distance of the eye from the transparent plane (*fig.* 41 *d*). If the line in space intersect the transparent plane at *an angle of more than* 45°, the vanishing-point which marks the intersection is called *the point of incidence* (*fig.* 45 D2).

5. All *curved lines*, *angles*, and *figures* on an object, which lie in a plane whose extension would pass *through the eye* of the draughtsman, appear in the image as *straight lines*; the more or less *curved* appearance of *curved lines*, or *broad* appearance of *angles* and *figures* in the image, is in direct proportion to the distance at which the extension of their planes would pass *over*, *under*, or *right or left from the eye* of the draughtsman (*pl.* 20, *figs.* 8 and 9, the middle lines; *figs.* 1, 2, and *pl.* 21, *figs.* 6–11, the auxiliary lines through the eyes and points of the noses).

The methods of determining these various points and the horizon in the plane of a picture can only be explained practically by elaborate deductions and with the assistance of models, and the instruction in these methods must be obtained from a teacher in a progressive course of lessons. Regarding their theory we offer the following remarks.

The paper of the draughtsman, or the *plane of the picture*, represents the transparent plane itself, the frame of the former or its circumscription coinciding with the limits of the latter (*pl.* 19, *figs.* 41–45, the rectangles circumscribing the drawings). The *lines of construction* drawn on the plane of the picture are partly those enumerated above, in part such as the draughtsman originally imagined drawn in space from his eye to points of the object or parallel to some of its lines, and which are, as it were, *folded* or *flapped into* the plane of the picture. The student of the art of drawing must acquire the faculty of imagining such constructive lines projecting into space before and behind the plane of the picture, in order to understand construction and to apply it. This accomplishment can only be attained by the study of perspective in models and by continued systematic lessons in drawing from nature.

The same course of study is requisite to prepare and qualify the student for a due consideration of some points of particular importance in pictorial perspective, viz. the selection of the precise place for the transparent plane, and of the proper distance of the point of view from, as well as its position (line of sight) with respect to the transparent plane.

Concerning the *position* of the transparent plane, the general rule, in case a single angular body is to be drawn, is to place the plane vertically

before the same in such a manner that it is in contact with one corner or edge of the body, forming with its principal front an angle of less than 45°. If a number of objects are to be drawn in one group, the rule is to place the transparent plane parallel to the front of one of them (*pl.* 19, *figs.* 40–45). In drawing inclosed spaces (rooms, churches, &c.), the front wall is usually imagined as removed and replaced by the transparent plane and the eye of the draughtsman on its exterior side. In drawing an open landscape, and this is the most difficult case, two points on the ground have to be selected and retained, through which the transparent plane is imagined to pass vertically; whilst the plane itself must be imagined as bounded on the right and left sides by perpendiculars, and above and below by horizontal lines, these four lines encompassing everything in the landscape that is to be included in the picture, and excluding everything that is not to be drawn. The boundary lines of the fictitious transparent plane must then correspond with the lines circumscribing the paper or the plane of the picture.

The *distance* of the draughtsman from the transparent plane must at least be great enough to allow the eye to survey its limits without any motion of the head, either sideways, or upwards, or downwards. A common distance is the diagonal or better twice the length of the transparent plane. If the distance be chosen too small (*pl.* 19, *fig.* 43) the eye is easily fatigued in the survey, and the objects appear as unusual images, *in perspective distortion. Fig.* 44 offers a favorable contrast, being taken from the right distance, whilst *fig.* 43 is taken from a distance not exceeding the breadth of the image. On the other hand, if the distance be chosen too great, the smaller parts of the object lose in clearness, and the picture fails in expressing the depth to which the receding parts extend.

The *altitude of the point of view* before the transparent plane above the base of the latter, *i. e.* the height of the *point of sight* or of the *horizon* in the drawing, is most natural at the elevation of the eye of a standing man above the ground (*pl.* 19, *figs.* 42, 45). If the ground be covered by but few objects, or if it be empty or barren, the altitude of the point of view should be decreased; the ground will then appear less extended in the picture. If the altitude be *too limited* the appearance of the ground will approach too much that of a straight line, and the objects on it will cover each other too much. If on the other hand it be *too great* (*fig.* 42) the ground will appear too extended, the lines on it too steep, and the objects in the *depth* too much as if they were placed above each other; and if the point of view be higher than the upper surfaces of the objects, the drawing will have the appearance of a horizontal projection: in landscapes that of a topographical map. The *proper* height of the point of view can only be determined for every special case by a practised judgment, developed by continued drawing from nature.

The *lateral position of the point of view* with respect to the vertical axis of the transparent plane varies according to the object to be drawn. If this be a *single rounded object* the draughtsman places himself *precisely opposite the axis* of the plane, or so that the line of sight intersect it at right angles (*pl.*

21, *figs.* 18–21); but if it be an *angular object* having lateral surfaces (*pl.* 19, *fig.* 40) he selects a point *at either side of the axis.* If a *group of several objects* is to be drawn, the point of view is taken *opposite its vertical axis;* especially in historical compositions of human figures and in open landscapes. An exception from this rule is made in the case of avenues and streets, of rooms, churches, and similar bounded spaces in which the objects on the two sides are mostly parallel, their lines receding at right angles from the transparent plane. If in such a case the point of view were taken opposite the vertical axis a perspective symmetry would be the result, making the impression of monotony or stiffness (*pl.* 19, *figs.* 43, 44). It is therefore preferable to choose a point of view on either side of the vertical axis, thus avoiding the unpleasant effects of perspective symmetry (*pl.* 19, *fig.* 45).

In conclusion, we call attention to the necessity of placing finished natural drawings in a *certain position to the eye of the beholder*, in order that the *images* of the objects may appear to him as *real objects in space.* This one true position of the drawing is that in which its plane has *the same angle of intersection with* his line of sight, and *the same distance from* his point of view, which the transparent plane had *with* the line of sight, and *from* the point of view of the draughtsman. The drawing must therefore be held before the beholder in such a manner that his eye shall be *precisely opposite the point of sight in the drawing*, and at a distance *precisely equalling the distance in the drawing.* Thus the cross of cubes (*pl.* 19, *fig.* 40) must be held a certain distance to the left from the eye; the rooms (*figs.* 43, 44) straight before the eye; and the group of buildings (*fig.* 45) a little to the right of the eye; in all three cases at such an elevation that the horizon marked in the figures be in the horizontal plane of the eye. If in these drawings the points of sight were not indicated, they would be found by prolonging the receding horizontal lines. In drawings that are destitute of such receding horizontal lines, the determination of the horizon and point of sight requires elaborate constructions, but a practised eye very easily discovers the right point of view for the inspection of a good drawing, without such construction, by means of a well developed sense of beauty.

These remarks about the right position for viewing a drawing are of even greater importance for making a correct copy of a finished drawing. It is therefore of little use, and even absurd, to let pupils draw from finished patterns before they are thoroughly acquainted with the rules of perspective and their application.

In order to show how necessary is a strict attention to general and special morphology, and to the rules of perspective, even in drawing single natural forms, we subjoin an outline of the rules for drawing the human figure.

C. Drawing of the Human Figure.

In the following remarks reference is had throughout to a purely ideal human figure, forming, as it were, a medium between the innumerable individual figures produced by nature, from the normal proportions of which

those of individual figures differ more or less. In drawing from nature or from models, the individual deviations from the normal figure must be determined and correctly rendered in the drawing. Thereby only will the individual character of a given person be clearly expressed, since individuality is the deviation from the normal. The proportional numbers given, having reference partly to actual measurements in space on the body or model, in part to measurements of its image on the transparent plane in certain definite positions, must be modified, in drawing from nature, according to the perspective phenomena of each special case.

1. THE HEAD. In examining the various component parts of the human figure, we begin with the head as the most characteristic, the rules for drawing whose details we will briefly lay down.

In order to produce a correct drawing of the *nose in front view*, we divide its whole length from the root to the tip (*pl.* 19, *figs.* 13, 14) into four equal parts, of which one (0,1) will be required for the distance from the root to the point of incidence of the eye-brows, or to the beginning of the nasal bone; two (1,2, and 2,3) for the bridge of the nose, which is often left unmarked by lines; and the fourth part (3,4) for the tip and wings of the nose. The breadth of the nose is divided into six equal parts, of which the first on either side is required for the projection of the wings of the nose; the next on either side for the projection of the nostril; and the two middle ones for the projection of the rounded part of the tip of the nose, which however will appear to project a little below the level of the wings (marked by the line 4,0), since the tip, in passing towards the upper lip, is drawn somewhat down, as seen in the side view of a nose (*fig.* 15), but the proper tip or end of the nose lies on the line 4,0.

The *eye* is drawn in front view most easily if we divide its height into four equal parts, the uppermost for the upper eyelid, and the remaining three for the field of vision. The middle one will then form the diameter of the pupil, and the two others the visible parts of the iris or apple of the eye, which is three parts in diameter. The length of the eye not turned to one side (*a*, *b*, *fig.* 1) is equal to twice its height; the line of direction, however, is not perfectly horizontal, but sinks a very little towards the nose; the eye too when seen from the side (*fig.* 2) is drawn in a little towards the bottom. As soon as the look is turned towards the one side or the other, the appearance of the eye is shortened; and as it is a rounded body, the lines of direction, which in the full front view are projections of curved lines, must receive their proper curve by the help of perspective, as shown in the eyes, *figs.* 3, 4, 7, and 9. *Figs.* 5, 6, 8, 10, 11, and 12, exhibit the human eye in various positions of the features of the face, and in various directions of the transparent plane, and more or less closed.

For the *mouth*, whose regular length is determined by drawing lines from the middle of the forehead touching the wings of the nose and continued to the line of the mouth, we divide the height for a front view, into five equal parts (*fig.* 16), two of which belong to the upper and three to the lower lip. *Figs.* 18 and 19 give a side view of the mouth, and show how the lower lip recedes somewhat from the line of the upper lip; hence the

dotted perpendicular central line, when the mouth is turned to one side, appears not straight but curved, as shown in *fig.* 17.

The contour of the *ear* in a front view is a somewhat obliquely lying oval (*fig.* 20), whose axes bear to each other the proportion of two to three. The cavity of the ear takes in a third part of its height. The ear itself is one of the most elaborately constructed parts of the human head, and it is necessary to study it in all possible positions and foreshortenings. *Figs.* 21–27 will serve as guides to the drawing of the ear in very different positions of the head to the transparent plane.

If we now turn our attention to the drawing of the *head as a whole*, we have first of all to study the form of the skull. A front or straight profile view of the rounded part can be obtained most easily by constructing an oval line in the following manner: from the centre s (*pl.* 20, *fig.* 4) describe the circle $l\ v\ e$; and from t, where $s\ t = \frac{1}{2}\ s\ v$, describe another circle $u\ k$, whose radius is one eighth smaller than $s\ v$. Through s draw the perpendicular line $l\ q$, which gives the middle line of the ear, whose height equals $\frac{1}{3}$ of $l\ e$. The distance from e to q we make also $\frac{1}{3}$ of $l\ e$; so that $l\ q$, the whole height of the head, is four times the length of the nose. The part $e\ q$ serves to form the mouth and chin, the next third gives the length of the nose, the next the forehead to where the hair begins, and the last the receding part of the front of the head. The lowermost portion $e\ q$ is subdivided into five parts, of which one fifth gives the upper lip, one fifth the mouth, and three fifths the chin. The line $k\ g$, which touches the middle of the forehead and the under lip, varies in its direction according to the different races of man. In the Caucasian race, g stands back from b about half the length of the nose; while in negroes it advances almost two thirds the length of the nose (*fig.* 7). In old men whose mouths are sunken in owing to the loss of the teeth (*fig.* 3), this line touches the point of the chin. In children the lower part of whose face is not yet fully developed (*fig.* 5), it does not amount to the entire length of a nose.

In order to draw the front view of a face, we likewise begin by constructing the oval (*fig.* 7). This is effected by describing two circles, the upper and larger one with a diameter one and a half times the length of the nose; and the lower one, whose centre lies within the circumference of the larger circle, with a diameter equal to the length of the nose. In children the proportions are different, as represented in *fig.* 8. When the oval has been drawn, we divide its breadth (*pl.* 21, *figs.* 16 and 17) into five parts, and its height into four. The division of the breadth is applied as follows: the middle fifth gives the distance between the eyes; the two next following, the eyes themselves; and the two outer ones, the part of the skull receding towards the temples. The division of the height is the same as described in speaking of the profile head. Yet we must observe here that in the female head the skull is somewhat flatter above, and the eye is placed a fifth of its height lower than in males. The breadth of the neck (*pl.* 21, *fig.* 16) is $1\frac{3}{4}$ the length of the nose; and its length (*fig.* 17) to the pit of the neck is $1\frac{1}{3}$ the length of the nose.

Thus far we have spoken of the head only as presented to us in profile or

en face; and here the lines of division were projections of the curved lines of the form of the head, and appeared as straight. But when the head is turned from either of these positions, these lines exhibit to a greater or less extent their curved form; that is to say, when the front face is simply turned upwards or downwards, the horizontal dividing lines become curves, as in *fig.* 11; but if the head be turned in two directions, all the dividing-lines become curves. *Figs.* 6, 7, 8, 9, and 10, present a complete guide to the drawing of these lines of direction and explain themselves. The lower part of the face is given rather more in detail in *figs.* 1, 2, 3, 4, and 5. On the other hand, *pl.* 20, *figs.* 1 and 2, show the manner of sketching heads in profile. Heads copied in detail from the antique are given (*pl.* 21, *figs.* 19, 20) in profile; *fig.* 21 shows a head *en face* turned to one side; *pl.* 20, *fig.* 9, a child's head in contour; and *fig.* 10, a similar head half shaded.

2. Hands and Feet. Having given the most necessary directions for drawing the head we now turn our attention to the other parts of the body, and first of all to the *hands.* In order to learn to draw correctly a hand, open, stretched out, and parallel to the transparent plane, its whole length should be divided into two parts, one of which forms the fingers and the other the palm. The portion that forms the fingers is to be subdivided into 12 parts, of which 7 give the length of the thumb, 10 that of the forefinger, 12 the middle finger, 11 the ring finger, and 9 the little finger. The breadth of the metacarpus is equal to its length; and by dividing the latter into two parts, we determine the point at which the thumb begins. The breadth of the metacarpus divided into four parts gives that of the fingers at their roots; these taper towards their tips, and are each to be divided into three parts, of which the middle is a little larger than the lower part, and this latter than the part ending in the tip. The thumb has only two parts, as the third lies within the circumference of the metacarpus. When the hand is turned sideways and the fingers bent, considerable modifications of the given proportions will arise by perspective; and on account of its many diffierent parts and the very various positions they may assume with respect to each other, the drawing of the hand becomes very difficult, and we often find it out of proportion even in good pictures and by celebrated masters. In *pl.* 20, *figs.* 17, 18, 20, we have given hands drawn from the inside; in *fig.* 21, two hands clasped together; and in *fig.* 19, an extended hand drawn from the outside. *Pl.* 19, *fig.* 36, represents the back of a hand with the fingers bent; *fig.* 33, a hand turned sideways; and *figs.* 32, 34–39, represent hands holding various objects, and hence wholly or partially closed. The hands of females are in general distinguished by plumpness, while in those of males the sinews and muscles appear more prominently. Our readers will easily distinguish the male from the female hands in the drawings.

The proportions of the *foot* may best be represented in the following manner. The foot is thrice as long as it is high; consequently, in order to draw a foot as seen directly from the side, we begin by constructing a rectangle of the above mentioned proportions. Then by describing from the lower front angle, with a radius equal to two thirds the length of the

foot, an arc intersecting the upper boundary line of the rectangle, we obtain the point at which the leg joins the foot; and by describing from this same point an arc with a radius equal to the entire length of the foot, we obtain the direction of the heel. The general course of the instep is given by a line drawn from the junction of the foot and leg to the lower angle of the parallelogram in front. This line, together with the heel and the base-line of the rectangle, marks the rectilinear general form of the profile of the foot, within which are the place of the ankle-bone and the curved line of the ends of the toes, whose precise positions must be determined by their appearance on the transparent plane. An upper view of the foot may be drawn in a similar rectangle.

When the foot is turned about in any other position, the phenomena of perspective become more prominent, as well as in the foot's motions, which are usually performed not on the toes but on the ball of the foot (*figs.* 30, 31). A man's feet, standing upright and seen almost directly from the front, are delineated in *fig.* 29, and a woman's feet (those of the Venus di Medici), to which the remark applies that we have made above respecting the hands, in *fig.* 28.

3. THE ENTIRE BODY. The first thing to be considered in drawing the *body* is the proportioning of the several parts to each other. The proportions, however, keep constantly varying until the individual has attained his full growth, *i. e.* before his twenty-first year. The length of the head, or, according to other masters, that of the face, has been taken as a unit, with reference to which the measure of all the other parts has been determined. Now the proportion of the head to the whole length of the body is different in different years. In the new-born child, the head usually comprises one fourth of the entire length; in one three years old it is one fifth of the length; and in an adult it is one eighth. In a child three years old, like those represented in the groups in *pl.* 20, *figs.* 11 and 12, the head is a fifth part of the whole length; in one of seven years it amounts to only two thirteenths; while in one of twelve years it is almost one seventh. In a youth of seventeen the head is $\frac{4}{31}$ of the length; and a full grown man has a length of eight heads or ten faces. In females the proportion is always rather less.

The division of the body into lengths of the head is shown in *pl.* 21; the front view is given in *fig.* 14, and the back view in *fig.* 15. One head-length is taken up by the head, the second dividing-line passes through the nipples, or through the shoulder-blades at one third of their height from the bottom. The third goes through the navel, and the fourth through the share-bone. From there down to the knee are two head-lengths, and the remaining two head-lengths go to the legs. The arms, together with the hands, contain three head-lengths. All these proportions, with the variations they undergo in the different years of growth, must be minutely observed, otherwise, instead of drawing children, we shall merely represent adults on a small scale. The breadths in the above-mentioned figures are given in lengths of the face. *Pl.* 20, *figs.* 13 and 14, show the whole somewhat more in detail; and *pl.* 21, *figs.* 12 and 13, show the deviations of the pro-

portions in the female figure, where all appears rounder and more delicate; the region of the hips too is quite differently proportioned. *Fig.* 18 represents a male torso, in which the muscles are brought out more prominently.

In order to be able to draw a figure with correctness and elegance, it is not sufficient to know the proportions of length and breadth as displayed in the finest antiques; we must likewise know the anatomical and statical rules according to which the various parts of the body, in motions and attitudes, preserve their equilibrium. Here, too, the antique affords us the best information. For greater clearness we give an example.

If we wish to draw a figure in the attitude of rest, the body must rest on one leg, say, as in *figs.* 14 and 15, the left. The left hip will then become thicker, and must stand higher than the right; because the body, when resting upon the left leg, throws itself together on that side over the hip. The shoulders and hips must never stand parallel; while the right leg, thrown as it were out of use, is bent, the thigh being turned forwards and the leg backwards, the right arm must be raised, or in motion, while the left hangs down at ease. Nature itself teaches us this; for in walking and moving about, the left foot and right arm are advanced together, and vice versa, the hands must also move differently; if we see the inside of one, we must be able to see the back of the other. When a person is walking, the hips swell out little or not at all, but the breast must always be thrown forwards perpendicularly over the advancing leg; when the right leg is thrown forwards the left elbow is thrown back. When a person is at rest the whole weight rests on the advanced foot; the breast is thrown forwards, the head a little back; one foot is raised slightly from the ground. Diligent observation of correct works of art is calculated to afford more information with regard to the method of representing correctly, *i. e.* naturally, than volumes of theoretical advice on drawing and painting.

D. Composition.

To *compose*, in the Fine Arts, is to give to an *idea* which is to be conveyed, the right *expression* and *natural forms* in artistical arrangement. The leading rule in all kinds of composition is to *aim at beauty*. *Beauty* in composition is identical with *unity of idea and form.* Every picture ought to have *only one* prominent idea. Our definition of artistical beauty contains therefore the law for compositions of more than one individual form. This law is: the *composition* must be *a whole.* No part of it must be overwrought, none slighted. All component parts must be essential, and must stand in relation to each other; not only in an inward or ideal relation, but also in an outer or visible one, so that every part may bear upon and contribute towards the composition as a whole. Some of the parts, those which give the principal expression to the composition, must predominate; others, those which assist towards and complete the total expression aimed at, must be less prominent; all must be subordinate to a centre in space, which at the same time represents the central point of the idea; a centre which, while it is supported by the other parts, is itself the centre of their attraction and combination in an artistical whole.

Every composition includes three *forces*, whose perfect equilibrium is essential to beauty. From their equal co-operation arise the life and individuality of the composition, and that unity which quiets, gratifies, and delights. The prevalence of any one leads to deficiency both in correctness and beauty. These three *artistical forces* (or *momenta*) are objectivity, subjectivity, and space.

The first force, *objectivity*, centres in the object of the composition. This object bears in itself the law for its formation and representation. It is the artist's first duty to form a purely objective conception of his object, which he can only do by setting aside his own individual view of the same, and subordinating himself to the object. He must therefore, above all, make himself thoroughly acquainted with the real appearance of his object, and strive to render it in his composition so completely, that a clear view and room for an untrammelled judgment are afforded the beholder, whether the object be taken from nature or from history. This can often be done only by indicating in subordinate parts the condition of the principal object immediately before or immediately after the time of its actual condition. Such indications must, however, be introduced with judicious economy, as they may very easily disturb the unity of the composition. They ought to explain the object completely. But completeness and prolixity are two very different things; a subject is exhausted as soon as it has been made clear.

The second force, *subjectivity*, is the artist's own *feeling* for his object or his view or judgment of the same. Its seat is the depth of the artist's soul. He that cannot transfer to the representation of his object part of his best and loftiest feelings, his enthusiasm for humanity, liberty, or other sublime ideas, may fill the plane of his picture with abstract tokens for objects or ideas, but he can never inspire them with the breath of soul. It is true that every object fit for artistical representation contains in itself the law of this representation, and, as it were, presents itself ready for introduction into the composition. But every educated man looks upon every object in his own peculiar subjective manner. This may be compared to a positive *law* passed by a legislative power which receives different *interpretations* from those intrusted with its execution. Only he who himself feels can inspire feelings. He that cannot stamp the representation of the object of his picture with that expression which makes it a truthful picture, replete with life (which makes it *his own* picture), may not aspire to the name of artist; he will never be original; he is a mere copyist, imitating the forms of nature, or painting hieroglyphics for ideas. An excess of subjectivity must, however, be carefully avoided, by which the truth of the objective image would be impaired. For if the artist portrays his own fancy instead of the object, and fills his picture with allegories of dreamy perceptions, or with events foreign to the actions of his object, his picture becomes confused and the beholder is puzzled. The subjective force of the picture should be limited to the enlistment of that sympathy of the beholder for its object, which will induce him to form his own opinion about it, and impress the latter upon him in the shape either of a distinct recollection of, or of an enthusiastic feeling for the object, or both.

The third force of a composition is *space:* first, that which is occupied by natural forms expressive of the idea the picture is to convey; and, second, that which is filled by the artist according to artistical rules, with graceful forms harmonizing the coloring and grouping of the picture as a whole. The former may be occupied by a single figure or by a group. Every single figure is determined with regard to its general action and expression as soon as it has been chosen as an element of the composition. In endeavoring to give it truth to nature, the artist will at the same time secure its special individuality. In divesting it of all that is wanting in beauty or superfluous in its outward appearance, he imparts to it an ideal expression. The æsthetical law of contrast in space has already been adverted to in the theory of drawing the human figure, and we have there given a few examples showing the different positions required for corresponding limbs in order to produce a pleasant effect. We here add a few rules concerning the requisite contrast in space in compositions. If a part of an arm or leg appear fore-shortened the other part must appear in full. If an arm and its hand be extended, the latter must not have precisely the same direction as the arm, but must assume a different position by a gentle flexion. Fore-shortenings must also be contrasted among themselves; *e. g.* if the right upper arm be fore-shortened, the left thigh must be so too. It is self-evident that circumstances require occasional deviations from these and similar rules, especially in positions and motions determined by actions. Rules of artistical practice, in general, must be applied with careful judgment and such modifications as are dictated by the nature of the special cases. An inconsiderate adoption and application of such general rules easily lead to stiff theatrical effects. A *group* is constituted by several single figures only by their approximation in space in such a manner that their limbs are in part intermingled, or that they at least exhibit contrasts of motion within a certain space, which originate in reciprocity of cause and effect. Of artistical *general forms of single groups* in compositions, the *pyramidal* has been most frequently employed. The nature of special actions requires, however, often a different form of group. In great compositions several groups are often combined into a larger unit in space. In this case a *central figure* or a *central group* is required to which the *lateral groups* should stand in the relation of contrasts to their unity.

Relative to given spaces (walls of rooms, churches, halls, &c.) we observe that objects represented in them, whether scenes of nature or history, are not products of true art unless they attain the perfection and unity of a real architectural ornament. In the arrangement of such compositions attention must be paid, not only to the general form of the grand group of objects represented, but also to the general form of the remaining part of the space, and definite harmonious proportions must be given to these two divisions of the space. If the composition in itself be intended to be the principal source of effect, extremes of decorations in the space have to be carefully avoided lest the substance of the object be sacrificed, and characters degraded to mere arabesques, in favor of a symmetry or an external harmony flattering the eye.

E. Illumination.

The supply of light by which an object becomes visible is called *illumination.* It requires a special course of study similar to that of perspective to render its effects on *single objects* in a drawing. The requisite information is imparted by a special division of the theory of the art of drawing, called *projection of light and shade*, and it can only be properly practised in drawing from models. Presupposing this study, we offer the following remarks on *pictorial illumination* in general. In nature, light admits of endless variety; and according as it varies, the object produces a different impression upon the eye. The effects of different kinds of illumination are often so diverse that it is difficult to persuade ourselves that we see the same object. It would be a fruitless undertaking to endeavor to describe completely the effects of the various kinds of illumination; we will only call the artist's attention to the fact that the knowledge of illumination is an important branch of painting, and even of composition, since the choice made of it co-operates in determining the tone of a picture. Nature is here the best instructor; and the mode of profiting by her teachings is to observe a landscape under a very bright and very cloudy sky, in moderate daylight and strong sunshine, when the sun is high and when he is low in the heavens, and with the light falling upon it in front, on the side, and in the rear. Under each of these altered conditions we behold a different picture. When the painter observes a happy or an ill effect, let him investigate the cause of the same. It is only thus that he can obtain a perfect knowledge of the effects of illumination, so as to employ it properly in his pictures. It would be of great advantage to a painting-academy if it were furnished with a kind of stage resembling that of a theatre, on which various models and complete grouped pictures could be exposed to every kind of illumination and from every direction, while the back-grounds by means of curtains could be represented in various degrees of brightness.

F. The Various Kinds of Painting.

The products of the art of painting may be classified according to their several principal objects of representation. The designation of the various branches of the art under this classification are, *Portrait Painting*, *Historical Painting*, *Religious Painting*, *Painting of Low Life; Landscape Painting* including the special branches, *Naval Painting*, *Painting of Animal Life*, &c.

If, however, we consider the phases of life represented in art, in nature as well as in history, we find two principal classes of painting, the *Painting of Conditions*, and the *Painting of History in Nature and Life.* The latter class would naturally include all historical paintings proper; but it includes also everything that is popularly designated as *Genre Painting* and, what may be considered still more strange, a part of landscape painting, whilst another part belongs to the painting of conditions. As this classification, though strictly logical in every instance, would involve difficulties arising from the unfamiliarity of the majority of readers with its motives,

we propose to group our remarks under the three universally familiar heads of *Genre Painting*, *Historical Painting*, and *Landscape Painting*. We must, however, previously advert to a very common error, namely that of calling a picture either a "genre picture" or a "historical picture" with a view of designating its "triviality" or its "excellence." Such a designation with such a motive is absurd, because a "genre picture proper" can have the same degree of "classical excellence" as a "historical picture proper" of the same perfection.

1. Genre Painting aims at representing nature, and more especially man in a *definite condition of existence.* It represents its object *at rest* or at least not engaged in any action of historical importance or influence on his own fate or that of others. It may portray an *individual* as the representative of his *class*, or in his own accidental personality with its restrictions. It may also depict several individuals whose collective representations offer a *picture of life*, or of *domestic*, or *social*, or *such conditions as belong to the landscape;* not of such conditions which only exist for moments in the historical transition from past to future, but of such as exist for longer periods of life or recur at intervals. It is self-evident that such conditions most frequently have reference to objects of *every-day life;* but *products of poetic invention* also, and even *historical subjects*, as far as they depict local conditions or conditions of kindly humor, afford objects for genre-painting. It has attained to this extent since artists have begun to form a true conception of its real nature; viz. since, not confining themselves to a mechanical imitation of objects in nature or even to their accidental attributes, they have sought rather to represent their condition, and to unite with truth to nature an admissible degree of ideality, by a careful selection and artistical arrangement of their objects. Therefore genre-painting in its higher products passes into historical painting.

2. Historical Painting. The term historical painting in its widest sense is applied to every picture which depicts important historical events, and whose chief contents are either nature herself in her grand evolutions (thunder-storms, gales at sea, &c.), or acting personages whose dispositions and feelings or tragical fate are portrayed. The historical painter is the painter of the historical development of nature and of the human mind. If a historical painting possessed no other excellences but those of art or technical skill, *i. e.* a perfect disposition of its parts, correct drawing, and good coloring, it would still be a poor one if wanting in the significance we have indicated, and in expression. As a work of art it should not only captivate the eye, but it should also take hold of the feelings and inspire the mind of the beholder with the higher ideas of life. The first care of the artist who desires to produce a historical picture should be a proper choice of his subject; and herein but too many failures are made. Insignificant transactions, if only described in detail in the Bible, in Mythology, or in History, are too often selected as materials, and even by good painters, when no reasonable being would go ten steps to see the thing itself that is represented. The historical painter should choose only events of importance,

moments of the development of a higher idea, or of the contest for or against the same. When he has found such a subject, he should think over his representation from figure to figure, and resigning himself to the feelings which the invisible part of the matter awakens in his mind, these he should strive to depict. The painter should reflect, too, that his vocation is different from that of the historiographer. He is not to record events historically, but to represent their spirit, and he that is incapable of doing this should be anything rather than a historical painter. When the painter has found the material and has determined its spirit, let him choose the moment of action, and let him examine whether it be possible so to represent it that it cannot be mistaken for any other. Here Delaroche, for instance, has failed in his *Napoleon in Fontainebleau*, since he has depicted Napoleon sitting as he might have done after the loss of any battle, and consequently was obliged to add the date on the frame. This shows that the artist himself perceived that his picture was a failure as a historical painting, though one of the best paintings of the age as expressive of condition, so that it would be justly called a genre picture of the first rank if genre painting admitted tragical subjects. The contents of the picture should be manifest at once to a person of education, and he should be conducted precisely to the point at which the action has arrived. Both these requisites are often very difficult; but of the older painters, Raphael, and among living artists, Kaulbach, Lessing, and others, give many examples of their fulfilment. Much, very much can be effected in this respect by a proper management of accessories, as is shown by the modern historical painters in contradistinction to the older ones. In the further extension of the design, the persons are first to be considered. Let the painter choose such as are characteristic and connected with the action, and represent them in the attitude suitable to the moment. Idle personages disturb the effect of a picture as much as of an animated scene in a drama. None but a painter destitute of genius scrapes together as much corporeal material as he can, in order to satisfy the eye; a great painter endeavors to produce the greatest results by means of the smallest number of persons, because he has a great deal to express in a single one. In doing this he must carefully avoid an excess of symbolical indications. It is only after having thus selected his characters and accessories that he can proceed to actual composition. From this it will be perceived how difficult it is to produce a perfect historical picture. The historical painter must not only have a rich imagination, must not only be master of coloring, costume, and history; these qualities, it is true, would enable him to produce natural representations, but to attain to the inward power of a historical picture they could not suffice. The painter should represent nothing common-place; he should produce pictures that represent the past in the enlightened spirit of the present, and which by this spirit (that of liberty and humanity) will operate on the mind and feelings; and therefore, in addition to all the above mentioned accomplishments, he must himself possess a mind capable of understanding the highest aspirations of his own and the ideal aims of future times; and the highest enthusiasm for this

historical development of ideas must fill his breast, to enable him to represent them.

3. Landscape Painting. Among the arts of design that of landscape painting holds an important rank. The beholder of a good landscape picture whose mind is capable of penetrating the depths of nature in a scientific spirit, looks upon that picture as a moment of the everlasting life of nature, fixed by the painter. The delight which nearly all men take in the beauties of nature proves the intimate connexion that exists between it and the human mind. Rarely does the faculty of taste receive such perfect gratification from any source as that which it derives from the contemplation of open nature. The endless variety and the intimate harmony of its colors charm the eye almost whithersoever it turns. Whatever can be imagined of delightful, great, or wonderful in form and shape is there met with; and yet in each landscape all the various and endlessly commingled forms constitute a harmonious whole, and all is so combined together that notwithstanding the indescribable multiplicity of images, none contradicts the other, while each breathes a spirit of its own. Painting accordingly is provided in nature with an inexhaustible fund of materials for operating advantageously on the mind of man; and the landscape painter, if acquainted with the higher powers of his art, and if he connects moral and pathetic subjects with the scenes of nature, can in many ways usefully and delightfully entertain the beholder. By means of a well chosen scene of social life, and by a proper combination of living figures, he can give to his landscape a value that places it upon a par with the best historical painting; nay, a landscape becomes itself a historical painting, when it represents grand actions of the forces of nature or their visible results.

To work up a landscape to the highest degree of perfection exhausts all the resources of natural science, of the finest taste, and of the profoundest art. A great landscape painter must unite in himself almost all the talents of every other class of painters. Before all things the painter, when he has found a landscape proper for representation, should remove from it everything foreign and superfluous, but retain to the most minute peculiarity everything typical, in order that its appropriate character may not be disturbed. In order to give unity to the piece, it is necessary that in every landscape there be a single spot to serve as a central point of interest to the whole, while nothing at the edge of the picture must be made so prominent as to divert the attention. Landscapes, such as exist even by good masters, which represent a broad tract of country where everything is beautiful and interesting, so that they might be cut up into several small pieces, each of which would form a pretty landscape, can never produce a grand effect. In a good landscape the light and shade must consist of principal masses which offer no particularly prominent points, but which approach to a roundish appearance when viewed from a distance. A number of the landscapes of Wouvermann, few of the older, but a majority of the works of the best modern landscape painters, Achenbach, Lessing, Turner, and others, can stand this test. If from a distance we see light and dark patches scattered about a picture, it will not produce a powerful effect when viewed near at hand. Here

almost everything depends on the light admitted into the picture; for a landscape which is charming by the light of evening may be only tolerable in the morning light. Hence the painter should study the landscape which he chooses for his subject under every kind of light; and the authors of drawing-books should make it a point to represent the same landscape under very different lights, in order to show the pupil the various effects of illumination. All that it would be needful to say on the special points of drawing and coloring could be comprised in a single rule; but to carry out perfectly this single rule the greatest genius requires an entire lifetime. In drawing and coloring all should be so executed that the eye may be completely deceived into the belief that it sees nature itself. How protracted and minute a study of the conformations of earth, water, clouds, and vegetation, of perspective, of coloring, and of all the effects of light and shade, is needed in order to attain this end for the different seasons, and even for the different times of day, it is unnecessary that we should here enlarge upon.

4. Graphics.

The term *Graphics* denotes the art of drawing in general, including that of writing; but it is likewise taken in a narrower sense, and thus we will use it, to signify all those arts whose object is to put the productions of the draughtsman into a form that will admit of their being multiplied by impression. The oldest of this class of arts is Engraving Stamps, &c.

A. Engraving Stamps and Gems.

The art of gem-engraving was known to the ancients, and works of the kind are still extant which were produced by the oldest nations of which we have any knowledge, as has already been shown in our treatise on Plastics, where we also remarked that the engraved stones of the flourishing period of art in Greece and Rome are still among the finest of that class of works of art. The same is true to a great extent of the coins which were produced by the art of stamp-cutting, a stamp being engraved in hard metal and the coin struck with it in soft metal, as is done at the present day. The process of stamp-cutting is too generally known to make it necessary for us to say anything further concerning it; but we will add a few words respecting the technics of engraving on stones.

Gem-engraving is not executed by hand simply, but by the aid of a contrivance which bears the closest resemblance to a small turning-lathe, the spindle of which is set in motion by a cord-wheel. This spindle in the mandril has at the end a square hole, in which the cutting instruments, technically called *hands*, are stuck and made fast. These hands are small steel rods, having at the end a small head, disk, point, or knob, by means of which the figures are cut in the stone either raised above the surface (*cameos*) or depressed below it (*intaglios*). For cutting glass or the softer stones the instrument is moistened with oil or emery, but oil and diamond-

dust are used for the harder stones. Preparatory to the design the stone is first ground dim; and after the design is completed, the outline is cut in with the cutting-hand (*pl.* 22, *fig.* 36 to the left). The manner of applying the stone, cemented to a support, to the hand, is shown in *fig.* 9. With the flat hand (*fig.* 36 to the right) level, and with the rounded index (*fig.* 37), rounded depressions are hollowed out; shallow depressions are excavated with the flat pearl (*fig.* 38 to the left) and deeper ones with the round pearl (*fig.* 38 to the right), and points are made with the pointed hands. Of every sort of hand and pearl there are many different sizes, to suit the degree of fineness of the drawing. It will of course be understood that the cutting, properly speaking, is effected, not by the instrument, but by the emery or diamond-dust applied to it. When the engraving is finished, the gem is afterwards polished again. This brief notice of the subject will show that the whole art consists in presenting the stone in the proper direction to the cutting tool, which has no other than a simple rotary motion; and that everything depends on the light and certain motion and the delicate feeling of the artist's hand. This and the want of any contrivance to facilitate the execution, render gem-engraving one of the most difficult of arts.

B. Wood-Engraving.

The art of wood-engraving is likewise of great antiquity; for the Chinese cut their written characters in wood and then printed them, a thousand years before our era; and even the Hindoos had their wood-cuts more than a century before Christ. In Europe wood-cutting was improved, and brought into frequent use by the making of playing-cards, in the beginning of the fourteenth century, when these cards came into fashion; after which it was applied to the representation of sacred personages and scenes in the *Biblia pauperum.* The oldest cut of the kind is supposed to be the St. Christopher of the year 1423. The legends on these pictures occasioned the invention of the art of printing. A variety of the art of wood-cutting is furnished by the so-called *chiaroscuros* or *camayeux*, which were invented in Germany in the time of Dürer, and were improved in Italy by Hugo da Carpi. For each picture he used three or four blocks, the first of which contained the outlines and the deepest shades, and each of the others one of the middle tints up to the lightest of them. This gave to the impressions the appearance of drawings. Raphael, Titian, Rubens, and many others, caused their works to be multiplied in this manner. We have many celebrated masters belonging to the earlier period of wood engraving, *e. g.* Meidenbuch, Pleydenwurf, Schnitzer, Hans von Kulmbach, Mich. Wolgemuth, Albr. Dürer, Kranach, Holbein, Altorfer, &c. After 1610, wood engraving greatly declined, and at length was applied only to tapestry and calico printing. It was reserved for recent times to restore the wood-cut to its early dignity. The chief impulse was given in England, and especially by the founding of the Penny Magazine. It was to contain a great many illustrations, but was to be published very cheaply and at very short intervals, which rendered it necessary that the pictures should be printed along with the letter-press. This of course could be effected only by the aid of

wood-engraving, and great pains were bestowed upon its revival. The first step towards improvement was to cease cutting the blocks with the grain as was practised in the middle ages, and to cut them out of box-wood across the grain. In this manner not only a finer and more even surface was produced, but the laying open of the numerous pores made the block better adapted to receive the printing-ink. The second principal improvement was to exchange the use of the knife formerly employed for the burin of the copper-plate engraver, so that the block was no longer *cut* but *engraved.* In Germany there are now but few, though these are the most celebrated artists, who understand the far more difficult art of cutting on the side of the woody fibre; among these are Unzelmann, Kretzschmar, and Gubitz. The third, and perhaps the greatest of the improvements in wood-engraving, is that of varying the height of the block's surface. When the engraving is executed upon a perfectly even surface, all the lines which are to appear in the printing must stand in relief, while in the places that are to remain white, a portion of the thickness of the wood must be removed; a line, of course, must make throughout its whole length an equally black impression, and the only way of lightening the shade is to make the lines finer, and to increase the breadth of the white spaces between them. But even then the lines cut off suddenly will press their ends sharply into the soft paper, where not unlikely they will make little black spots, such as often disfigure the older wood-cuts. Hence it becomes necessary that the lightly-shaded parts should be treated in some way to prevent their taking up and giving off too much color. The object was effected by lowering such parts a little below the proper type-level, so that during the impression these sunken lines and shadows but slightly touch the paper, the inking-roller likewise imparting to them less color than to the more elevated portions. This process produces the most admirable results, but it requires very skilful artists; because those parts of the design which have been lowered must be drawn over again. It has been erroneously supposed that the lowering of the face of the block to obtain lighter shades was an invention of Thomas Bewick in 1828. As Bewick was a self-taught artist, the idea may have been original with him; although he practised it long before 1828, which was the year of his death. The same expedient, however, was in use centuries before his time, as may be seen by referring to Jackson's Treatise on Wood-Engraving, *p.* 548.

The English acted on the spur of practical utility; to the useful the French added the agreeable, and to them we owe the first editions of classical writers illustrated with wood-engravings. In Germany, also, the utility of the art of wood-engraving soon became apparent. Gubitz, in a manner, created this art anew in Germany, and his productions are still among the best. His pupils are found everywhere. He was followed by Blasius Höfel in Vienna, who also invented *chromo-xylography*, or a mode of printing in different colors by using a succession of blocks of the same size, each having only those objects engraved on it which are to appear in one particular color, a sort of *chiaroscuro* or *camayeux.* Germany is now rich in artists who can compete with the best English and French wood-engravers,

and who indeed frequently surpass the latter in thorough technical knowledge of their art. It would lead us too far were we to undertake to enumerate all the artists who have distinguished themselves in xylography in Germany: among them are Unzelmann, Kretzschmar, Vogel, Georgy, Braun, Flegel, Deis, Ehrhardt, Rietschel von Hartenbach, &c. The greatest progress in recent times has been effected by Kretzschmar; for while most of his fellow-artists devote themselves to rapid execution, and the producing of effect in the service of the book trade, Kretzschmar has striven to obtain recognition for the true art that lies in wood engraving, and to prevent xylography from becoming the mere handmaid of typography. His wood engravings for D'Alton's Anatomy are true works of art; and his splendid xylographic production, the *Death of Gustavus Adolphus*, after a design by Kirchhof, is probably the largest wood-cut ever executed on one block. In this work the art has probably attained to its highest pitch.

A subordinate branch of wood-cutting is formed by the preparation of the blocks for paper-hangings and calico-printing, in which the principal lines of the pattern carved in relief on pear-tree wood, and little figures, vines, &c., are cut out of brass and driven into the block. Here too there is a sort of *camayeux*, since for calico from four to eight, and for paper-hangings as many as thirty blocks are used for as many different colors, which certainly produces very beautiful results.

C. Engraving in Metals.

The art of engraving designs in metals in intaglio was known to the most ancient nations: many examples of such engravings are mentioned in the Bible and in the writings of the ancients, and also of the practice of filling up the engravings in one metal with another metal, so that, *e. g.* silver and steel were inlaid with gold. The so called *niello-work* was very much admired in the middle ages. The design was engraved in silver, and the sunken lines were filled with a composition of 1 oz. of fine silver, 2 oz. of refined copper, and 3 oz. of lead, to which virgin sulphur and borax were added as a flux. The molten mass was then poured upon the heated plate, which was afterward scraped and polished off till the engravings appeared sharp and black upon the shining ground. In this process originated the art of copper-plate engraving.

1. Copper-plate Engraving. This is the art of transferring a design to a copper-plate, so as to admit of its being multiplied by impression. Tomaso Finiguerra, a skilful goldsmith, wishing to try the effect of a plate engraved for niello, had smoked it and then polished it again; so that the soot only filled the engraved lines, as the niello composition was intended to do afterwards. The idea occurred to him of laying over it a damp sheet of paper and passing over the latter a soft brush, by which means he obtained a reversed impression of the plate. This took place in the year 1452, and the transition from niello-work to copper-plate engraving was easily made. So the matter is related by some, and the story seems not improbable; but Vasari says that the artist, in order to preserve a model of his work, made a mould of it in sand and then took a sulphur cast,

after which he blackened the cast and accidentally took an impression of it.

Copper, however, was not employed at first for printing from; the earliest works were engraved on tin, zinc, or iron, and afterwards the idea was adopted of using very fine-grained, homogeneous, and tolerably hard copper. The oldest known German copper-plate is of the year 1465, and is marked E. S. More than 120 plates have come down to us executed by the same master, but of which only ten bear the dates 1465, 1466, and 1467; the remainder are without date, and may very possibly be still older. The art of copper-plate engraving, properly so called, was introduced from Germany into Italy by Sweynheim, who settled there in 1467; at least so he says himself in his preface to Ptolemy's Geography. With the beginning of the sixteenth century the new art spread over all Europe, and it has been practised with the greatest zeal ever since. Its productions are genuine works of art, which, although destitute of the charm of coloring, often represent nature in the most pleasing manner.

There are as many as eleven different modes of engraving on copper, viz. 1. Copper-plate engraving properly so called, executed with the graver or burin; 2. Engraving with the dry-point; 3. Etching (*pl.* 22, *fig.* 2); 4. Etching and finishing with the graver (*fig.* 3); 5. Stippling (*fig.* 6 exhibits this manner combined with No. 1); 6. Mezzotinto (*fig.* 4); 7. The Le Blon process with various colors; 8. The chalk manner; 9. English stippling; 10. Aquatint engraving (*fig.* 5); 11. The aquarelle manner.

The plate intended for engraving must be hammered cold, or still better rolled very hard; it must then be rubbed with sandstone, next with pumice-stone, and lastly with moistened charcoal; after which it must be polished. For all the kinds of engraving above mentioned, excepting Nos. 6, 7, and 11, the plate is now covered with a priming or *ground*. For this purpose it is placed over a hot charcoal brazier; and then is rubbed to and fro with the etching-ground tied up in silk (*fig.* 10), which is composed of wax, asphaltum, colophony, and mastic or Burgundy pitch. The etching-ground, which is liable to come off in some places, is then evenly distributed over the plate by means of Tampon's *dabber*, a ball made of cotton wool tied up tightly in silk (*fig.* 11), so that the ground is made of equal thickness throughout. The design is then copied in outline on the ground. For this purpose the ground is either whitened with washed white-lead and gum, or fastened in a hand-vice (*pl.* 22, *fig.* 8 *a*) and blackened by passing it backwards and forwards over a wax taper; and to this ground the drawing is transferred, in the usual manner, with tracing paper or by pressure on the back of the drawing. If the drawing is to be on a smaller scale than the original, the reduction is effected by the aid of a reducing frame (*fig.* 34).

In the *first* mode of engraving, the outline drawing is scored through the ground with an etching-needle or dry-point, a sharp-pointed instrument of steel; after which the plate is cleansed and the engraving proper begins. The instrument which the copper-plate engraver makes use of is the *graver* of hardened steel (*figs.* 23–26), one end of which is pointed and the other

secured in a wooden handle. The gravers are ground off obliquely at the point, and the face is either low, *i. e.* forms a square (*figs.* 25 *a* and 25 *b*), or high, *i. e.* lozenge-shaped (*fig.* 24 *b*); there are also knife-gravers (*figs.* 26), whose face forms a very acute-angled triangle. The low-faced graver is used for tracing out the design, the high-faced for deepening the strokes, and the knife-graver for fine, very sharp lines. The beard or burr that forms on the edge of the stroke is removed with the *scraper* (*figs.* 14 and 15), which serves also to scrape out slight faults; and any roughness that may be produced in consequence is rubbed down with the *burnisher* (*fig.* 16). The graver lies while at work almost flat on the plate; the manner of holding it is shown in *figs.* 7 and 8. For very broad lines gravers are used with faces formed as in *figs.* 26 *a* and 26 *b*. During the process of engraving the plate lies either on a sand-bag (engraving-cushion) or on a desk-shaped easel (*fig.* 7 *a*), and in executing curved lines it is turned round with the left hand. In order to examine portions of his work as they are executed, the artist rubs them over with the *oil-rubber* (*fig.* 9), which consists of a ball of felt rolled tightly together, on which there is some lamp-black moistened with oil. If any mistakes are made which are too deep to be effaced by the scraper, they must be *knocked up*. This is done from the back; the plate is laid on a small anvil (*fig.* 31), and the knocking up is done either with the hammer (*fig.* 32) alone, or, if the places are very small, with a punch (*figs.* 29 and 30), which is placed upon the faulty spot and struck with the hammer. The back of the spot to be effaced is found by means of the callipers (*fig.* 27) or of the improved compasses (*figs.* 28 *a* and 28 *b*). Straight lines are drawn with the *ruler* (*fig.* 12) and parallels with the *parallel ruler* (*fig.* 13); but such surfaces and tints as are formed wholly of parallel lines are now almost always ruled with the machine. The laying down of curved lines is a chief object of care with the artist, who must lay them according to the rules of perspective in order to represent the roundings of the forms. For this purpose the apparatus represented in *pl.* 22, *fig.* 35, is of use, where the shadows cast by the threads of the frame upon the bust indicate the correct perspective curve of the strokes to be used in delineating it.

In the *second* mode of engraving, with the dry-point, the strokes are cut through the ground with steel needles of various shapes, and frequently these strokes run cross-wise over each other. This mode of engraving demands great certainty in the artist, and then it furnishes very fine and delicate work, which, however, will seldom bear more than 200 impressions.

The *third* mode of engraving, that of etching, is entirely different from the preceding. Here the ground is not removed when the outline is done, but the whole drawing with all its shades, &c., is completed in it. For this purpose variously shaped etching-needles of hardened steel (*figs.* 20, 21, 22) are employed, which are handled like lead-pencils, excepting that each stroke must pierce through the ground so as to lay the plate bare. When the drawing has been gone over in this manner, the artist proceeds to *biting in*. The etching-liquor consists of nitric acid diluted with rain-water. For this purpose the plate is surrounded by a border of yellow wax, which is smeared

over with a coating-varnish composed of tallow, yellow wax, and sweet oil, or of etching-ground dissolved in oil of lavender. When this is dry, the etching-liquor is poured on, is left about a minute to act, and is then poured off again; the plate is then washed and dried quickly either in the open air or by blowing it with a bellows. Those parts which are to be the highest are then covered or *stopped out*, as it is called, with coating varnish; and as soon as it is sufficiently dried, the etching-liquor is poured on again, left a minute to act, and again poured off. This process is repeated for each degree of shade, and the deepest is usually attained by allowing the acid to act from seven to nine minutes; accordingly there will be from seven to nine shades in the whole plate. When the biting in is finished, the plate is dried and the etching-ground removed; and if the work has been carefully performed, the strokes will appear as if engraved. The work is accomplished far more expeditiously than with the graver, but not with the same sharpness and purity. Etching on soft ground (*fig.* 1) is a very easy kind of etching. The ground used in the process is so soft, that the lightest stroke removes it. If we lay upon the plate so grounded a sheet of rough but very thin paper, and draw upon it with a hard lead-pencil, the etching-ground under the lines will adhere to the rough paper and separate from the plate. When the paper is removed, the drawing appears as if sketched with chalk, the plate showing bare through, and can then be etched in the usual manner.

In order to give the etched plate a more elegant finish, it is re-engraved with the graver in the *fourth* manner of engraving; and by means of this combination of the three first methods of engraving most of our present copper-plates are executed.

In the *fifth* mode of engraving the goldsmith's punch is made use of, and by means of it dots are struck in the plate, which in the shaded parts are either placed thicker together or made larger, and sometimes both methods are resorted to. The punch usually has two and often three or more points. It is struck with a small hammer. Work executed in this manner presents great softness in the transitions, and chalk drawings are imitated by means of it; but it is altogether destitute of sharpness and force, on which account it is often employed for the flesh-tints alone, while the remainder is executed with the graver or the needle in the line manner.

The *sixth* mode of engraving is that of mezzotint. It is the opposite of the former modes, as it proceeds by converting dark into light. The polished plate is first roughened, so that if inked and printed it would present one mass of black. This grounding or roughening is performed by means of the rocking-tool or *cradle* (*pl.* 22, *fig.* 17), a toothed instrument of steel, which is worked accross the plate with a pretty strong pressure in all directions in the manner of the lines drawn in *fig.* 33; others use the *roulette* (*fig.* 18) or the *scratcher* (*fig.* 19), which they apply in the same manner as the cradle. According as the teeth of the implement stand closer or wider apart, the grounding will be fine or coarse. The plate is next covered with etching-ground, the design transferred to it, and the outlines bitten in; after which the plate is again thoroughly cleaned. Then with the scraper the

grounding is removed according to the various degrees of shade required; so that in the strongest lights the smooth plate again appears, and is even polished again. This method, which is exceedingly tedious, produces a remarkably soft effect when completed, but will hardly furnish 150 perfect impressions.

The *seventh* mode, that of printing in several colors, differs from the preceding in this respect, that for each color a different plate must be engraved; but lately a method has been discovered of printing several colors from a *single* plate, which is called "coloring in the plate." This trifling, however, has been almost wholly confined to France and England.

The *eighth* mode of engraving, the chalk manner, is only a variety of the stippling process, which is applied to the etching-ground, while instead of the single-pointed needle one of several tolerably blunt points is used, together with the roulette, with which the strokes are dotted. By this method strokes are obtained which look as if made with chalk.

The *ninth* mode, the English dotted manner, answers precisely to the stippling above mentioned, except that it is applied to the etching-ground, and no roulette is used in it.

The *tenth* mode, called aquatint engraving, differs from the preceding, and is, properly speaking, etched mezzotinto. Here the outlines are first sketched and bitten in. The plate having been cleansed, there is sifted over it, according to the fineness of the grain desired, some more or less finely powdered colophony, after which it is set over a gentle charcoal fire. The resin will melt on the plate in the form of small grains, between which the plate will be exposed. All that is to remain quite white is covered over with coating-varnish, and the design is bitten in as in etching, the different degrees of shade being stopped out as they are etched dark enough; the plate is then retouched in order to preserve the soft transitions, after which it is ready for printing. Sometimes, too, strokes are laid with the graver in the deepest shades.

The *eleventh* or aquarelle process is the same with that of Le Blon (the seventh mode), except that the plates are worked in the aquatint instead of in the mezzotint manner; it is however but little used, if at all.

Map-engraving and letter-engraving form special branches of the engraving art. These demand a separate study, the main requisites being great uniformity and freedom of stroke. Hence the artists in these branches seldom engrave other works, and figure and landscape engravers never work on lettering or maps. The letter-engraver should possess a knowledge of the written character of the most diverse nations; and we have given, for his assistance, in *pls.* 23 and 24 a variety of Oriental alphabets, with the names and powers of the letters, together with the alphabets used in Europe already. Letter-engravers are accustomed first to etch the characters and then to go over them with the graver, by which means the work acquires greater freedom. Attempts been very recently been made to form letters by means of machines and to etch them altogether. The artistic department of the house which has issued the plates of this work (F. A.

Brockhaus, Leipsic) possesses a letter-engraving machine invented by C. Kretzschmar of Leipsic, which works admirably.

2. Steel-plate Engraving. The art of engraving on steel was invented by the English in the year 1820, and the principal credit of it is due to the copper-plate engraver Charles Heath; but it required British inventive genius and British perseverance to subdue that hard and brittle material to the operations of the graver and etching-needle. This art did not reach the Continent till some time later, and indeed in England itself it remained for a considerable time in the possession of individuals; but now steel-engravings are produced in France, Italy, and Germany equally as good as those of England. One part of the process, namely the etching-liquor, the English attempt still to keep a secret; but German ingenuity has long ago supplied this deficiency, and the entire process is no secret now.

The plates made use of in steel-engraving, or siderography, are of the finest English cast-steel with the stamp of Huntsman or Martial. *Acier poule*, or blistered steel, is also employed in France and Switzerland. All this is *steel of cementation*, *i. e.* it is produced in the cement-furnace by being subjected to a long continued and powerful heat in a mixture of animal and vegetable substances and pounded glass; and it is better, harder, more brittle, more uniform, and more finely grained, and can be more easily and uniformly hardened than the other sorts of steel. The plates, in order to guard against the warping to which they are liable in consequence of their cementation, are made somewhat thicker than copper plates. The cementation renders the plates, at least on the surface, quite soft; if they have become somewhat warped, they are straightened by hammering them with a wooden hammer on an anvil; they are then easily ground and polished.

The ground and polished plate is thoroughly cleaned with spirits of turpentine, and is then coated with etching-ground in the same manner as a copper plate; but it must not be heated as strongly as the copper, for otherwise the ground will be apt to break up and form blisters, and even to evaporate. The etching-ground dissolved in spirits of turpentine may also be laid on with the brush, but always more thickly than on copper. When the outline of the drawing has been properly sketched or transferred, it is etched through precisely as in working on copper; but care must be taken that the needle actually scratches the surface of the plate, while the artist must be cautious not to breathe upon his work, lest it produce rust in the etchings, which will prove an obstacle to the subsequent biting in. The chief requisite now is a suitable menstruum or etching-liquor. Almost every engraver has a mixture of his own, which he naturally considers the best. We will here give only the one invented by Cooke in 1827, and which obtained the gold medal of Isis. When the plate is ready for biting in, mix and gently shake together six parts of acetic and one part of nitric acid, and pour this mixture upon the plate. As it acts very rapidly, it should not be left on the plate more than half a minute, at the expiration of which time the plate should be washed clean and dried with a gentle warmth or by blowing with the bellows. The light parts of the drawing

are now done, and, as in copper-engraving, are to be stopped out with varnish. There is then poured upon the plate, in order to wash the oxide out of the strokes, a mixture of six parts of water and one part of nitric acid: this is left to stand two or three minutes, is then poured off, and immediately the menstruum is applied with which the second tint is etched. The same process is gone through for the other tints. If the plates be very soft, the following menstruum may be employed: 3 oz. warm water, 4 grains tartaric acid, 4 drops nitric or sulphuric acid, and 1 drachm corrosive sublimate. Every time a plate is bitten in, it is carefully gone over with a camel's hair pencil dipped in clean water, and then immediately dried, in order that no oxide may be left in the strokes. Places which are not yet deep enough are rebitten, which is done by dipping a clean rag in greatly diluted nitric acid (so that the water has merely a sharp acid taste) and passing it over the places until they become dull, when the plate is cleaned again.

The stopping out, even of whole surfaces, is never done with the dabber, but always with the pencil, as the dabber is apt to remove the etching-ground. As the chief point in etching is to see that the menstruum acts precisely the proper time, the light tints must be tried each minute after the first biting in; with the deeper shades this is not necessary. The skies are bitten in after Cooke's method; the plate is inclined a little by means of wedges, the darker part lying foremost, and the acid is applied through a funnel, in the pipe of which a small stick is placed, and kept constantly in a perpendicular position by a string. The acid is let to fall on the darkest places, and to drop more rapidly or slowly according to the depth of the tint; this is managed by means of the stick, a tremulous motion being also communicated to the acid, until it floats over the whole sky. The etching-liquor should never stand more than one sixth of an inch above the plate; for otherwise the design cannot be accurately inspected and judged of. The process of biting in and re-biting must be performed in a temperature of at least 60° F., and if possible must be finished in the same day; because even in a very well cleaned plate an oxide will form in the strokes over night, which will prevent the etching-liquor from working properly the following day.

When the etching is completed, the ground is taken off with the aid of turpentine, any remaining oxide is removed from the plate, and its entire surface is then rubbed over with very fine emery-paper, which is first worn down a little on the back of the plate. By this operation the fine burr which is always found on the edges of the strokes is removed. When the plate is etched, and has been thoroughly cleaned, it is coated for re-engraving with a very thin layer of wax or of mutton-tallow, to prevent any oxide from forming in the strokes. Finally, the finished plate must be hardened again. This is done in hot olive oil, in which the plate neither warps nor cracks. The plate, however, remains in the hot oil only a few minutes, after which it is taken out and immediately plunged into cold water, where it stays till completely cooled. It is still better to substitute mercury for water in the process of hardening, as thereby the grey coating that forms on the steel is avoided, and the surface of the plate remains uninjured.

For the purpose of lightening the labor, the so-called *ruling-machines* have been invented, which are used for copper and steel engraving, and also in lithography. These machines are so contrived that parallel lines may be ruled with them with the utmost exactness at any desired distance apart, so as to yield two thousand or more lines to the inch; they are furnished with a diamond-pointed needle, which slightly cuts into the plate. These machines are employed for laying what are called the flat tints, and likewise for ruling parallel lines in drawings of architecture and machinery. Besides these there is the *relief-machine*, by means of which a relief is so minutely transferred by curved lines to a copper-plate as to give an astonishingly perfect imitation of the relief. M. Collas invented this machine in 1834, with which beautiful copies of gems and medals have been furnished.

D. Hyalography.

The discovery that fluoric acid corrodes glass has led to a very pleasing description of ornament; it is produced by coating a glass plate with an etching-ground in such manner as to leave clear certain parts forming a design. If such a plate be exposed to the fumes of fluoric acid, produced by pouring sulphuric acid over pulverized fluor, the exposed parts of the surface of the plate will be bitten in; and when the plate has been cleansed from the etching-ground, the drawing will present a dull appearance on the transparent ground of the glass plate. This art has very recently been brought to great perfection, and the neatest drawings have been executed by it. This fact presented to Prof. Böttcher, of Frankfort-on-the-Maine, who afterwards invented the gun-cotton, the idea of etching on glass with fluoric acid in the same manner that copper is etched. He coated a thick glass plate ground perfectly even with a peculiar etching-ground, and etched through it in the usual manner a design, which he then bit in with liquid fluoric acid. The process is kept a secret by the inventor, and nothing respecting it has been made public, except that several impressions of such plates have been exhibited. In order to print from the glass plate, it is cemented to a wooden block, and the impressions are taken by a lithographic press.

The impressions produced by this process are of exceeding fineness, and the strokes exhibit great delicacy; yet the deep shades are wanting in force, and the whole lacks a certain warmth possessed by engravings on copper and wood. It almost seems as if the hardness of the material had an influence on the warmth of the engraving, which is very perceptible when we compare a wood-cut, a copper-plate, and a steel and glass engraving together.

E. Lithography.

A very peculiar art is that invented by Sennefelder of printing on stone, called lithography. Instead of copper or steel plates, the artist makes use of finely ground slabs of the calcareous slate of Solenhofen, and the entire process is rather chemical than mechanical.

The invention of lithography was not a result of scientific speculation, but was for the most part an accidental phenomenon, intelligently observed and turned to good account. The real essence of lithography lies in the so-called chemical printing; for in the preparation of the stone there is much that is identical with the process of etching. This chemical printing is based on the repulsion that exists between grease and moisture, and the attraction that grease has for grease. Thus, in order to get a design on the stone, and afterwards to prepare it for printing, the design is drawn with some fatty substance on the nicely ground and polished stone, which must then be submitted to a chemical preparation, and all the places which are not drawn upon must be rendered impervious to grease by saturating them with a solution of gum-arabic, which sinks into the pores of the stone, and by washing them over with water. If now a roller charged with a fatty ink be passed over the dampened stone, all the strokes of the drawing, being greasy, will take ink from the roller; but the moistened parts of the stone, which are also made mucilaginous with the gum, will strongly repel the fatty ink, and thus remain perfectly clean. If, then, we lay upon the inked stone a sheet of damped paper, and pass the two under a press with a pretty sharp pressure, the paper will take the ink from the stone and exhibit an impression of the design. The wet sponge is passed over the stone again, again it is inked, and an impression taken; and thus, by repeating the process, thousands of impressions may be taken from a single drawing.

The design is put on the stone in very different ways; all the modes of drawing which are applied to paper have been made applicable, by the use of more or less precaution, to stone also. We will consider the principal modes more particularly.

1. The Pen-manner. This manner was the first, that invented by Sennefelder. In order to draw in the pen-manner on stone, the artist makes use of extremely elastic and very finely pointed steel pens, by means of which, and with an ink composed of wax, tallow, soap, mastic, and shellac, and colored with some soot, he draws his design completely on the smoothly ground and polished stone in the same manner as on paper. In order to prevent the ink from spreading on the stone, the latter is covered with a very fine coating of spirits of turpentine or soap and water. When the drawing is completed, which must be done with the greatest neatness and circumspection, taking particular care not to touch the stone with the hands or with anything else of a greasy nature excepting the ink, the next thing is to prepare it for printing. Over the stone is poured a very weak dilution of nitric acid (12°), which has the effect of converting those portions of the calcareous slate which have been impregnated with fat by means of the drawing, into oleo-margarate of lime, a fatty substance insoluble in water. When the stone has thus been *etched in*, it is rubbed over with a solution of gum-arabic in water of about the consistence of syrup. This gum-mucilage penetrates into the pores of the stone wherever there is no ink, and fixes itself so fast that it cannot be washed out again. The stone is now ready for printing. When this operation is to be performed, the stone is laid on the press. The press is a frame-work consisting of two stands, between

which turns a wooden or iron cylinder, and on this the press-bed runs to and fro either simply by its friction or by means of a strap. The table is prepared for receiving and holding the stone securely and has attached to it a *tympan* of leather stretched over an iron frame so as to open and shut by means of a hinge, and which when put down covers the stone without touching it. Above the cylinder are two cast-iron uprights, one at each end, in which the *scraper-box* works up and down. In this is fastened the *scraper*, a small strip of yoke-elm or apple-tree wood rounded on its lower edge, which is about two inches high, one inch thick, and of a length equal to the breadth of the drawing on the stone. When the printing is to begin, and the stone has been fixed in its place, the bed of the press is brought out so far that the stone can be uncovered by raising the tympan. The stone is then washed perfectly clean with pure water so as to remove all the gum, and the black strokes of the drawing are gone over with a little spirits of turpentine and water. A wooden roller covered with leather to render it elastic is rolled on the ink-table to supply it with printing-ink, and is then rolled in every direction over the sponged stone. All the places that have been drawn upon will now take ink, but those that have been saturated with the gum will remain completely white. A sheet of damped paper is laid upon the inked stone with some sheets of waste paper upon it as an overlayer, and then the leather tympan is shut down. The press-bed is now brought under the scraper, the latter is pressed down upon the stone with the proper degree of force, and the bed is slowly drawn along under the steady pressure of the scraper, until the scraper has passed over the whole of the design and the impression is finished. The scraper is then raised, the bed run out again, the tympan lifted, the overlay taken off, and the paper cautiously raised from the stone; and if the work has been well, carefully, and neatly performed, a successful copy of the drawing will be found upon it. The stone is again moistened with a soft sponge, the ink-roller pressed over it, another impression taken, and so on. When the printing is finished and the stone is laid by to be used again, it is first carefully cleaned, and then rolled in with a very greasy ink called *preserving-ink*, and afterwards coated with gum-solution, which is dried upon it.

If mistakes are made in the drawing, they must be neatly erased with the *scraper* (*pl.* 22, *figs.* 14 and 15), without taking any more from the stone than is absolutely necessary, after which the correction is introduced. If during the printing an alteration is to be made, the place is erased, the correction introduced, and then it is etched in when quite dry with a small pencil dipped in diluted nitric acid; the place is then gummed, and after a short time the printing is again proceeded with.

The pen-manner demands a great deal of labor and pains, if the drawing is to be executed with the requisite fineness and sharpness; because the greasy ink, in spite of all the precautions that may be taken, is sure to spread somewhat, and the ink, if it has the proper degree of greasiness, flows with difficulty from the pen. Hence another mode has been invented called,

2. The Engraving Manner. This is strictly speaking the reverse of the

pen-manner. In this method the nicely ground and polished stone is first etched and then coated with a layer of gum: thus prepared, if the roller were pressed over it, it would take no ink at all. When the stone has been washed off, it is next covered by the aid of a brush with an exceedingly fine coating of gum colored with red chalk or lamp-black; and as soon as the stone is dry, the drawing is sketched out. The artist then takes what are called engraving-points of the finest steel, which are ground sharp or blunt at the point; and with these he etches the drawing in the same manner as on copper-plate, taking care, however, not to go too deep into the stone. It is quite enough if he removes the coating of gum under the lines of the drawing, and the stroke appears perfectly white and makes a little dust. Broad spaces must be scraped perfectly level. It must be borne in mind that the light strokes on the dark ground seem broader than they really are, so that in the impression, where they show black on a white ground, they will be smaller. Consequently the artist is to make his strokes rather broader than would seem necessary. In this respect experience alone can serve as a guide. When the etching is completed and its effect ascertained, the entire stone is gone over either with linseed oil or with diluted preserving-ink, which is allowed to stand on it about half a minute. As it has all been prepared excepting the parts that have been laid bare, it follows that these only will take the grease, which the stone absorbs with great avidity. If the stone be now washed off and the inking-roller passed over it, all the greasy places will take ink, the rest remaining white. The stone can now be printed as if drawn with the pen; the impression, however, as well as the overlayer must be somewhat stronger than in the pen-manner. As the engraved drawing lies a little below the general surface of the stone, and hence does not readily take the ink from the roller, it is usual to rub it over well with pieces of felt or with blocks of wood covered with cloth, and to make the ink pretty thin.

3. The Chalk Manner. This method furnishes the best imitation of chalk-drawing on paper: but it requires great care both in the drawing and in the management of the printing; and it is necessary that the printer also should be an artist and understand drawing in the case of large and carefully executed works. For this as for other methods the stone is nicely ground and polished; fine sand is then sifted over the stone; and by grinding in the usual manner, a coarse or fine grain is given to the surface, as the nature of the drawing may require. A drawing made on a coarse grain will furnish not as fine but many more good impressions; while a stone more finely grained will furnish much more delicate impressions, but their number will be considerably less. A finely-grained stone, too, requires in the drawing, and particularly in the printing, very careful management.

The stone having been grained and very carefully cleaned, the drawing is put on it in the same manner as on paper by means of a chemical chalk, whose chief constituents are almost the same, only in different proportions, as in lithographic ink. It is customary to lay on the deepest shades, in order to obtain greater effect, with lithographic ink and the pencil. The design when completed is etched in rather more lightly than a pen-drawing;

it is then coated over with gum, and, after standing two or three hours, is printed in the same manner as a pen-drawing, using, however, a great deal more care.

4. DABBING METHOD. A peculiar mode of drawing, resembling the chalk manner, is that of dabbing, or the aquatint of lithography. A grain is produced on the stone as for a chalk drawing, and the outline is sketched with a pen or with chalk; all that is to remain white is covered with a solution of gum-arabic, to which is added a little ox-gall and cinnabar. Then the artist takes a pretty hard, flat ball, of fine leather, and with it gives the whole stone a uniform weak tone; this he does by dissolving some lithographic ink in lavender-oil, spreading it out on a glass or stone slab, taking a little on the ball and rubbing it out, and then spreading it over the stone with the proper degree of thickness by means of a gentle dabbing. The first tint is of course very light. As soon as it has been uniformly completed and is dry, all that is to retain this tint is coated with the composition given above; and when the composition is dry, the second tint, and so on, as in aquatint engraving on copper. When all is completed, the composition is softened with spring-water, and is removed by frequently washing off the stone. When it is clean and dry, it is retouched with chalk, and then treated in the same manner as a stone with a chalk drawing.

5. CHROMO-LITHOGRAPHY. Printing in colors on stone is a process now coming extensively into use, and which has already furnished very perfect results. For this purpose what is called an outline-stone is first drawn with the pen and etched. Then for each color of the design a separate stone must be prepared, on which is placed nothing but what is to have that single color. In order that the parts of the design on all the stones may accurately fit together, as many impressions as there are colors are taken from the outline stone, and then while still damp are pressed one on each stone, by which means the requisite number of similar drawings is obtained. These are now accurately marked out with chemical tints, *i. e.* all the parts which are to be hatched, as the shadings, are indicated with the pen; but where flat tints are drawn, the whole surface is covered with the pencil. In this manner is produced a red stone, a blue stone, &c. On the outline-stone is usually put all that is to be black. Judgment is required in the arrangement of the stones, as by printing one color over another various shades can often be obtained; thus, *e. g.* if a violet tint be desired, the parts to be so colored are drawn both on the blue and on the red stone, and the two colors are printed one over the other. So, too, the character of the colors can be altered by various shadings. When, for instance, in the green foliage of a drawing one part of the shadings is executed on the red and the other on the blue stone (the deepest shades come on the black stone), some of the green leaves will exhibit a different tone from the others, although both have the same green ground-color. Here experience must give the necessary knowledge. When all the color-stones are finished, etched, and gummed, first one color is printed, then the other, and so on, till at length the black stone is printed. Gold and silver are laid on by printing yellow or grey underneath, and then dusting upon it with a pencil

the proper colored bronze. Prussian blue is printed as a ground for ultramarine, which is then dusted upon it. In order that the color-stones may accurately fit one another, certain marks (points) are applied, according to which the paper is laid on. In the new and improved lithographic presses a pointing apparatus is used, which enables the printer to adjust the sheets with greater accuracy and expedition.

6. Autography. If drawings and especially writings in which no great elegance is required are to be very quickly multiplied, so that the preparation of a stone with the pen or the graver is out of the question, recourse is had to *autography*. In this process the drawing or writing is made with a very greasy lithographic ink on paper prepared for the purpose and coated with a thin layer of starch paste; and this when dry is pressed upon the smoothly polished stone. The mode of doing it is to damp the drawn or written paper on the back and let it soak in a little; then, the stone having been slightly warmed, the paper is laid upon it, care being taken not to move the paper after it has touched the stone; after which it is passed through the press, as in taking an impression, several times, each time increasing the pressure. The paper, which now cleaves fast to the stone, is wet with a sponge dipped in water acidified with a few drops of nitric acid, until it is loosened from the stone. If the paper then be carefully raised, it will be found that the writing or drawing has separated from the paper and attached itself to the stone. When the stone has become perfectly dry, it is slightly etched and gummed, and then it can be printed from in the same manner as a pen-drawing.

There are many different lithographic processes in addition to those here described, as machine-work, relief-work, pencil-work, brush-work, white ornaments on a black or machine-ruled ground, &c.; but, as it is not our intention to compose a manual of lithography, a fuller description of them would lead us too far.

III. MUSIC AND THE DRAMA.

1. Music.

We have already shown, in the general introduction to this department of our work (p. 2), that music belongs to the domain of art, and in particular to the fine arts; and here we may add that music is the art of expressing conditions and emotions of the soul by means of beautiful tones: its works are not submitted to our contemplation through the sense of sight; its effects are produced directly on the mind, and hence it is a purely mental art, of whose operation the understanding can give no account. In one sense it stands higher than poetry and higher than plastics and painting: on the one hand it expresses feelings and yearnings to which no words can be given, and is a sort of universal speech of the heart; and on the other hand it has the advantage over sculpture and painting, which repre-

sent sensible objects alone, and which only by an ingenious treatment and combination of them are able to act upon the mind. We will here give a brief sketch of the history of music.

A. Ancient Times.

Music, the language of the soul, belongs to the most ancient arts; for the Bible affords us circumstantial information respecting it, and names Jubal as the inventor of musical instruments, among which are mentioned the lute and the shepherd's pipe. In Job we read of timbrels, pipes, and lutes; and Moses mentions silver trumpets: his sister also was a singer, so that vocal music was already artistically practised. David's harp-playing is celebrated; and under Solomon, when the music of those times reached the summit of its perfection, the trumpet-music was performed by more than 4,000 persons. After Solomon music among the Israelites fell into decline, and during the Babylonian exile it ceased altogether; after the restoration the most zealous exertions of the high priests failed to restore it to its former state. Among the Egyptians too we find the clearest evidences of the cultivation of music as an art, in their representations of various musical instruments and of festivals and processions, which are found in great numbers in the temples and tombs, in the form both of reliefs and of paintings.

From Egypt music was carried to Greece, where it was greatly cultivated and improved; but we know little that is definite respecting it, not even how the choruses in the ancient tragedies were performed and accompanied. Music it is certain played an important part among the Greeks; and their legislators recommended the practice of it, as having a softening and humanizing effect. It was placed under the protection of two Muses, and was said to have been invented by Epimetheus and Prometheus. Great musicians attained celebrity, and the names of Orpheus and Amphion have been handed down to these distant ages. Among the cultivators and improvers of the art mythology enumerates the gods and goddesses Hermes, Minerva, Bacchus, Cadmus, Pan, Midas, Marsyas, &c. In the sixth century before Christ instrumental was separated from vocal music, and Lasos was the first writer on music in a theoretical point of view. Pythagoras also paid attention to the improvement of the art, and Aristoxenus founded a school of music. Euclid investigated the mathematical principles on which music is based. Music was transplanted from the Greeks to the Romans, who however cultivated it but little, as they considered it to be an enervating art; on this account it was reckoned among the employments of slaves and freedmen. Among the violent political revolutions that convulsed the Roman empire, music sank into the darkness of barbarism. The Gauls and the Germans are known to have had a sort of music; and the Scandinavians had their skalds, who, like the bards and druids, recited and perhaps also sang their sacred songs to the accompaniment of the harp.

It was not till the Christian worship assumed a more refined and elaborate form that music was again awakened from its slumber; it was then applied to the singing of the church, which consisted chiefly of the psalms

of David and the hymns preserved in the Old Testament. In the year 340 after Christ, singing at the Lord's supper was introduced; for this purpose they at first doubtless made use of heathen sacrificial melodies, to which Christian hymns were adapted.

B. The Middle Ages.

As early as the 4th century the Popes, *e. g.* Damasus, Ephraem Syrus, and Ambrose bishop of Milan (A. D. 396) exerted themselves for the improvement of music; and Pope Gregory the Great founded in the beginning of the 7th century a singing-school, for which the best ancient melodies were collected and arranged as chorals. Guido of Arezzo introduced an entirely new order into music, and was the first who attempted to write it with notes; his notation was improved by Franco of Cologne (1046) and John de Muris. In the year 980 Dunstan, Archbishop of Canterbury, introduced part-singing into use. Thus far music had been the property of the church; but now arose the master-singers, troubadours, and minnesingers, who either recited their poems in a melodramatic manner to the accompaniment of the cither and harp, or sang them to tunes of their own composing. In this manner the foundation of secular music was laid, and it flourished especially in the South of France, where music soon began to be used as an accompaniment to dancing. The troubadours and minnesingers led partly a wandering life, performing at courts and at the castles of knights; while some of them found a fixed abode in the residences of princes and of the highest personages among the knights: the real minnesingers were everywhere held in high esteem, and many a nobleman regarded it as an honor to belong to their order. Among them were Wolfram von Eschenbach, Walter von der Vogelweide, Otto von Bottenloben, and many others.

C. Modern Times.

At the revival of letters and science at the close of the fifteenth century, music also came in for its share of improvement, and particularly the part-music in the churches, which then assumed the character it has since maintained. And in this as in the other fine arts, Italy decidedly took the lead of the rest of Europe. The old church music still preserved in St. Peter's at Rome, consisting of the productions of Gafor, Patavino, Porta, and Zarlino, testifies to the great knowledge possessed by these masters of the rules of counterpoint, which at length degenerated in the hands of Berardi and Buocini into artificial trifling. But Palæstrina, and after him Anexis, Nanina de Vallerana, Velletri, and Allegri, restored church-music to its former dignity. At the close of the sixteenth century, music began to be applied to the ballad, canzonet, and madrigal, and still later to accompanying the choruses in theatrical representations. Then, too, arose the opera, and Galilæi, Caccini, Peri, and Monteverdo, effected an immense improvement by laying aside the difficult contrapuntal style of the church-music, by venturing on a freer musical phrasing, and by striving to connect the words with the music, and thus creating recitative. The first comic

opera was written by Vecchi. From Italy music in its cultivated form was transplanted in the beginning of the sixteenth century to the Netherlands, where the monk Hucbald, of Flanders, who lived as early as 930, was acquainted with four-part singing, and Ockerheim taught music theoretically in 1450. In Germany, England, and France, cultivated music was still a prerogative of the court, and the people were acquainted only with the music of songs and dances. Luther introduced the present practice of church singing in German, which had previously been in Latin. In the year 1628, Henry Schütz or, as he is sometimes called, Sagittarius, attempted to compose German operas, but with little success.

D. Recent Times.

Even in recent times, Italian music has unfortunately remained the oracle of composers and audiences, and but few German and French masters have been successful in competing with it. The older music of the present period, beginning with the last quarter of the seventeenth century, was distinguished by a very thin instrumentation, excellent melodies, and beautiful harmonies; whereas the newer and very latest music is often characterized by excessively powerful instrumentation, and by the introduction of many bold, unmotived, and striking melodies. If we now turn to Italian music, we find in the earlier part of this period church music predominating in the works of Scarlatti, Durante, Pergolese, Piccini, Jomelli, Paesiello, Traetta, Terradeglia, &c., who however also wrote for the opera, and especially comic pieces. In instrumentation were especially distinguished Corelli, Vivaldini, and Geminiani; and in chamber-music, Scarlatti, Tartini, Nandini, and Pugnani, who still for a while maintained the old strict style. But in the next ensuing period music sank more and more; its true essence, the carrying out of the theme, the harmony, and the proper choice of instrumental accompaniments, were neglected; all was made to depend on the skill and taste of the performer, and hence arose a rage for bravuras with trills, runs, and other difficulties, in which the real music appeared as a secondary matter. In the latest times this perverse taste also invaded the province of church-music; airs were written to suit the voices of singers, even Durante's pupils fell into an excess of instrumentation, and the Italian Sarti introduced in St. Petersburgh hunting-horns, and at last the firing of cannon into the accompaniment of his church-pieces, and in particular of a Te Deum. Only the works of Righini, Salieri, Cherubini, Spontini, and Paer, are comparatively free from traces of a national character; though much of it is yet perceptible in Spontini. Of the masters who composed in Italy the best are Caraffa, Nicolini, Fioravanti, Cimarosa, Zingarelli, Morlacchi, especially Bellini, and in a less degree Pucitta, Donizetti, Mercadante, and Coppola. Rossini appears as the representative of the latest Italian music, and unites in himself all the above-mentioned faults together with surpassing talent. His operas address themselves to and seduce the ear, even though his treatment of the text, numerous repetitions, cadenzas of the same stamp, &c., displease the judgment. Italy is especially rich in musical artists of every kind; among instrumentalists there are such names as Scarlatti, Tartini,

Paganini, Baccini, the sisters Milanollo, Clementini; and among vocalists Farinelli, Caffarelli, Caristeni, Crescentini, and Veluti (castrati); besides Liberati, Sandoni, Faustina Bordoni (afterwards Mad. Hasse), Allegrandi Teri, the sisters Sessi, Catalani, Camporesi, Pasta, Garcia-Malibran, Viardot-Garcia, Grisi, and also Bricci, Zezi, Rubini, Tamburini, Lablache, &c.

German music received its earliest cultivation in Austria and Bohemia. In the period immediately succeeding Luther's efforts in behalf of German psalmody, little was done for church music in general, although much was accomplished for the improvement of the organ and for the theory of music. Sebastian Bach and his sons, Händel, Marpurg, Mattheson, and Sorge were skilful theoreticians; but Händel was the only one that made his talents felt beyond the borders of Germany. Händel and Hasse composed operatic pieces, but only in the Italian style and in the Italian language. Still the study of thorough-bass was zealously pursued, and the names of Kirnberger and Albrechtsberger are everywhere held in high esteem at the present day. At the close of the 18th century Graun, Telemann, and the two Haydns, Fasch, Naumann, and Schicht distinguished themselves by their cantatas, motets, oratorios, and masses; and from this time forth song-writing was cultivated, especially by Zumsteeg, Zelter, and Reichardt. In theatrical music Gluck, Himmel, Benda, and Winter composed a great number of pieces for the opera; the highest degree of excellence in German music in respect to harmony, correct phrasing, and excellent instrumentation, was at that time attained by Joseph Haydn in chamber music, and in opera by Mozart, from whose school in this same department of the art proceeded the grand and comprehensive Beethoven. These have been succeeded by many distinguished names in German music; but future times must determine which of them will endure and which be forgotten. A fondness for music has been exhibited in Germany such as is hardly equalled in any other country; and the musical institutions and unions which have arisen during the present century in every district of Germany contribute exceedingly both to keeping up this fondness and to cultivating the art in all its branches. Among the coryphæi of this period were Beethoven, Spohr, Ries, Fr. Schubert, Lachner, Reissiger, and Lindpaintner; for the opera C. M. von Weber, Marschner, Wolfram, Chelard, Gläser, Kreutzer, Wagner, Meyerbeer, and Herold, although the two last inclined more to the French school, Wenzl Müller, Weigl, Lortzing, &c.; for songs Kücken, Curschmann, Schubert, Proch, &c.; and for dance-music Strauss, Lanner, Labitzky, Gungl, &c. Church music also stands now at a high pitch of excellence, and among those who have rendered themselves illustrious in this line are Mendelssohn-Bartholdy, Schneider, Stadler, Ritter von Seyfried, Aloys Schmitt, and others. The number of German musical artists since Quantz, who was the first to gain for himself a reputation abroad, is truly astonishing; and there is no instrument from the organ to the trombone, from the contrabasso to the jewsharp and mouth-harmonica, on which some itinerant German artist has not exhibited his skill both at home and abroad. The same is the case with singing: Mesdames Sonntag, Schröder Devrient, Fischer-Achten, Heinefetter, Cornet, Karl, Grünbaum, Schechner, and

Messrs. Fischer, Gerstäcker, Wild, Haizinger, Bader, Vetter, Martius, Tichatschek, and others, have rendered German song celebrated not only in their native country, but likewise in the rest of Europe.

French music, with the exception of the popular songs, is altogether an offshoot from that of Italy; and before Louis XIV. there was not a single French composer of reputation. The idea that it was possible to have a French opera had its birth under Mazarin; in 1560 Lambert set to music the libretto of a French opera by Perrin, and Lully first forsook the Italian manner in his compositions in 1677. His successors were Destouches, Monteclair, and Lalande, then Rameau and his successors Rebel, Francœur, Berton, &c. A brief applause was gained by the Italian-sounding pieces of Pergolese and the mongrel style of Rousseau. About 1760 Philidor and Monsigny appeared; and these were followed by Grétry and the German Gluck, who introduced a severer style into music. He was opposed by the Italian Piccini; and thus there were formed in France two widely opposite schools, the Gluckists and Piccinists. But soon by the efforts of the Germans, as Kreuzer, Herold, and others, German music came to be much esteemed, although the Italian always remained a great favorite. French music properly so called was not called into existence till after the establishment of the Conservatory in 1793; but from that time we meet with composers of note, as Méhul, Boildieu, Dalayrac, Le Sueur, Isouard, Paer, and many others. But it is in the 19th century that French music has attained the summit of its excellence; and the names of Auber, Halevy, Meyerbeer, Adam, Monpou, Ruolz, &c., denote the representatives of the French style. The *chansons* have been especially cultivated by Panzeron, and dance-music by Musard. In chamber and concert music Cherubini, Aimon, and Habeneck have distinguished themselves; and the last-mentioned especially has done much to render Beethoven and German music in general appreciated in France. Church music, however, has never yet met with any great success in that country; the French have but few organs, and accompany their psalmody with brass instruments. Choral singing is unknown; but sacred texts are often sung to opera melodies, and artists frequently seek to shine in the church. France is by no means deficient in performers; but the violin and the piano-forte are the favorite instruments and those most cultivated. We will mention here Baillot, Lafont, Beriot, Vieuxtemps, Chopin; the flutist Drouet; the violoncellist Servays; and among singers Nourrit and Cinti-Damoreau.

2. The Dramatic Art.

The art of representing a dramatic poem to the eye by means of living personages is called the Dramatic or Scenic Art; and it requires a most life-like impersonation by the aid of costumes, masks, and mimicry, an accurate conception of the character to be represented, a power of penetrating into the thoughts and ideas of the poet, a suitable delivery, and lastly an accurate adaptation of the scenery to time and place.

The scenic art was carried to considerable perfection among the Greeks, especially the Athenians; and Phrynichus was the first who introduced several speakers together upon the stage. At first the actors were chosen from the highest ranks of free citizens, and the poet himself appeared and conducted the whole; so that the performances resembled those at our amateur theatres. But as early as the time of Demosthenes acting had come to form a distinct profession, as the fondness of the Athenians for dramatic representations could not suffer them to be dependent on the good pleasure of chance performers. The place of the poet as conductor was taken by the Protagonist (or impersonator of the chief character), who was at the same time the manager of the company. Such troupes were formed chiefly in Athens, and then traversed the whole of Greece, giving their representations in the chief cities, on which occasions two rival companies would sometimes come in each other's way. The applause was as immoderate as the blame: and while Aristodemus earned a talent ($8,000) in two days, bad players were hissed and hooted from the stage, pelted with stones, and even condemned to be fined. Still actors in general, though for the most part they led a very loose life, were held in great esteem, and were often invited to the courts of foreign princes; they were even intrusted with important affairs of state, and the orators received instruction from them.

At first tragedy and comedy were mingled together in the Grecian drama; but afterwards, as civilization advanced, the two were separated, although in representations a tragedy was always succeeded by a farce.

Among the Romans national pieces were performed by the sons of Roman citizens; but the common pieces were left to mechanical players, *histriones*, who down to the time of Cicero belonged to the condition of slaves and were reckoned among the dregs of the people. Under Augustus persons of the higher ranks addicted themselves to acting; on which accout an edict was issued prohibiting knights and senators from going on the stage. Although players as a class stood in bad repute, still the best of them, as Roscius and Pylades, were treated with great consideration. The Etruscans also had plays; and among the Jews the first theatre was built under Herod.

Among Christian nations the dramatic art originated in the practice in schools and monasteries of throwing stories from the Bible and legends of saints into the form of dialogues, which were then performed by the scholars. Bishops Apollinarius of Laodicea and Gregory of Nazianzen exerted themselves greatly for the perfection of sacred tragedy, and the last named divine even wrote a tragedy himself entitled "The Sufferings of Christ." The celebrated nun Hroswitha wrote several Latin pieces for the same purpose. In the middle ages there arose in France, the so-called Mysteries, Miracles, and Morals, and in Italy the Impromptu Comedy (*Commedia dell' arte*), from which a more artistic drama was soon developed. In England the drama as early as the 16th century assumed a definite fixed form, and Shakspeare has gained undying fame by his contributions to it. In Spain the chief dramatic writers were Calderon and Lope de Vega; and

their pieces as well as those of Shakspeare, with certain modifications to adapt them to the altered taste of the age, are still the ornaments of all stages. The French drama had its origin in the above mentioned Mysteries, and had always at first a mystic and religious tendency; but about the close of the 17th and the beginning of the 18th century, Racine, Corneille, and Molière formed, according to the rules of Aristotle, a sort of canon, to regulate the planning and composition of a drama, and this canon is still to all intents and purposes in full force.

The German drama was cultivated the last. Here too the first beginnings were sacred tragedies and mysteries, which were performed by students; but as early as the 15th century the comedies of Terence were represented at Augsburg, and about a hundred years later the sacred comedies were performed by the pupils of the high schools both in public places and before private companies. The reformation here introduced a change, as in the Protestant high schools these performances ceased, although they were continued down to the 18th century in the Jesuit colleges. Out of the so-called itinerant students who took part in these performances there were now formed regular companies of players, who traversed the country up and down in all directions, staying as long at a place as the people cared to witness and listen to their tragedies, farces, and jests. The first strolling company of the kind who gained for themselves a certain reputation was that of Master Velten or Veltheim, who obtained their license in Saxony at the end of the 17th century: they accordingly styled themselves the "Royal Polish and Elector of Saxony's privileged Court-comedy," although they wandered about everywhere and performed in every considerable town of Germany. This company was the first to produce regularly composed dialogue pieces, which were translated by Velten from the Italian and Spanish, and doubtless too from the French; still the impromptu comedy retained its footing a good while longer in Germany. Several other troupes were formed after the pattern of Velten's; and these had among themselves a body of laws regulating the profession, in which the several classes of parts were as sharply distinguished from each other as at present. There was a king's agent, a tyrant's agent, a pantaloon, a merryman (styled *courtisan*, the former jack-pudding), &c. In the middle of the 18th century, when Germany advanced with giant steps in the cultivation of letters and arts, the drama also partook of the general progress; since men of talents and learning, as Schröder, Eckhof, Iffland, &c., devoted themselves to it, and rendered the actor's profession respected and honorable. At this time too began the erection of permanent theatres, where the better artists had engagements for life and received pensions for their old age, while youthful talents were cultivated in the newly erected theatrical schools. A distinguished reputation was gained and has been maintained down to the latest times by the Castle-theatre and the theatre at the Carinthian gate in Vienna, and by the theatres in Manheim, Gotha, Weimar, Hamburg, Berlin, Munich, Stuttgart, Dresden, Leipsic, &c., which were under the direction of such men as Dalberg, Goethe, Schröder, Eckhof, Iffland, &c. The most flourishing period of the scenic art was at the close of the preceding and the commencement of the

present century, when such poets as Iffland, Goethe, Schiller, &c., devoted their muse to the drama, and when more account was made of the proper artistic talents of the performers than now. At present immense sums are expended on elaborate scenery, splendid dresses and decorations, artificial effects by means of machinery, and on the construction and fitting up of the the building; but with the exception of a few very distinguished performers, the salaries given to the actors are not such that we can expect exhibitions of true artistic talent from them. The opera especially, with its costly accessories, has contributed a great deal to depress both the tragic and comic drama.

The Buildings.

As early as the times of the Greeks and Romans especial buildings were erected for musical and dramatic performances; and under the head of Architecture we have given descriptions and representations both of the odeons of the Greeks (page 41 and Plates Div. VII., *pl.* 17, *figs.* 1, 2, and 3) and of the amphitheatres of the Romans (page 65 and Plates Div. VII., *pl.* 14, *figs.* 2 and 3). In modern times great sums are expended on the erecting of concert-halls and theatres, and science has employed all its resources to construct them in the most suitable manner, so that they may meet the many requirements both of the public and the poet.

1. Odeons. The first and great requisite of a building destined for musical performance alone, is a large spacious hall constructed in accordance with the rules of acoustics. As such halls are found here and there in other large buildings, it rarely happens that buildings are erected exclusively for the purpose; nevertheless, the Odeon in Munich, the Singing Academy in Berlin, and the building of the Society of the Friends of Music in Vienna, furnish excellent specimens of this class of structures. The hall of performance should have an elevated stage for the musicians, and a space in front of it to afford convenient accommodation to the audiences that may be expected. Sometimes raised galleries are carried round the walls of the hall. As regards the form that should be given to a concert-hall, acousticians are not yet agreed. Some of them are in favor of an almost elliptical or semicircular form, while others prefer a rectangle, and each can adduce plausible reasons in support of his opinion. It seems to us that a very suitable form is an oblong rectangle with rounded corners. The ceiling should be built flat, or but very slightly vaulted. But above all things are required smooth walls, with as few breaks as possible; accordingly they must be kept free from curtains, as all interruptions and all draperies, especially of woollen, swallow up the sound and interfere with the resonance. In addition to the hall proper, an odeon should have apartments for the ticket-office, the ante-rooms, the wardrobe, and the retiring-rooms for the artists who are not constantly engaged in the performance. Separate entrances for the public and for the musicians should by all means be provided.

2. Theatres. The ancient theatres were very different from those in use at the present day; in the first place, because the performances took place in them in the day-time, and not as with us by artificial light in the even-

ing; again, because they were necessarily a good deal larger, the theatre in ancient times being a popular recreation furnished by the state, and the number of visitors consequently very large; and lastly, because the ancient spectacle and tragedy was very different, and much more simple than ours.

The form of the Greek theatres was mostly a semicircle, and they consisted of three parts, the *scena*, the *orchestra*, and the *theatrum* proper. The *scena* was usually raised eleven or twelve feet above the ground, and had walls at the sides and back, which served to support the decorations. In front of the scena was the stage (*proscenium*), a large rectangular space on which the performances took place; and the front part of the stage had a small projection (*logeion*), from which the actors addressed the chorus stationed in the orchestra or delivered their monologues. On both sides of the stage were rooms for the actors (*parascenia*), and the front part of the stage was adorned with statues which were different for different performances. The proscenium was connected with the orchestra by two flights of steps; one on the right for apparitions and personages coming from the lower world, and one on the left for those coming from the sea. The decorations on the walls of the scena had three doors, the middle, royal, or principal door, and the two side doors; persons from abroad came through that to the right, and those from the city through that to the left. Besides these there were other entrances from the parascenia. The place of our side-scenes or wings was supplied by the *periactoi*, three-sided scaffoldings, which revolved on their axes, and had different decorations on each side, one of which stood always parallel to the rows of spectators or to the orchestra. Against the rear wall of the scena were placed huge cloths or flats, which were pushed together when the scene was changed. The part of the scena behind the doors usually represented the interior of a house, and was decorated by means of revolving scenes. The scenery was shifted only between the acts, when the curtain, which during the performance was let down and lay behind the orchestra, had been drawn up again. The theatrical machinery consisted of machines for imitating thunder and lightning, and others for aiding the ascent and descent of the gods, and for representing them hovering in the air. The *orchestra* was the space between the scena and the theatrum, of a circular form, and situated somewhat lower than the scena. Here the chorus was stationed, and in the centre was a decorative part (*thymelæa*), which represented either an altar, a tomb, or a rostrum, according as one or the other was required. The two entrances into the orchestra stood open. The *theatrum*, or part assigned to the spectators, consisted of the rows of seats rising one above another in the form of an amphitheatre. The magistrates sat in the first or lowest rows; and then followed several flights or tiers, divided by broad passages or lobbies (*diazoma*), consisting the first of eleven, the second of twelve, and the third also of twelve rows of seats. Flights of steps, which ran from top to bottom through all the rows of seats, formed a connexion between them, and made each row accessible in from eight to twelve places.

In Rome, Marcus Æmilius Lepidus was the first to cause the erection

of a permanent theatre with seats; but Pompey built one of the kind of stone and marble. These theatres, it is true, were copied after those of the Greeks; still, to say nothing of their greater splendor, they presented many deviations. Thus, *e. g.* the orchestra was smaller; because no choruses appeared in the Roman theatre, and the orchestra was used as a place for seating distinguished persons. It answered to our pit. The stage was not raised as high, being only five feet above the ground, but it was larger than with the Greeks. Before it hung the principal curtain, which was let down at the beginning of the performance, and drawn up again at its close. Between the acts a simple curtain was drawn up. The doors had the same arrangement as with the Greeks; then came the revolving scenes; and then in front of all the above-mentioned large space, with two side walls on each side, also provided with doors, through one of which came persons from the city, and through the other persons from abroad. The seats were divided in the same manner as with the Greeks, except that taking in the orchestra gave them four tiers of seats instead of three (the *orchestra*, *podium* or *cavea ima*, *cavea media*, and *cavea summa*). The prætor had an elevated seat in the orchestra, among the senators; in the podium sat the vestals and knights; in the cavea media, persons of distinction; and in the cavea summa, the people. Behind the seats rose a portico to the same height as the scena, and immense awnings (*velaria*, *parapetasmata*) were drawn over the whole space allotted to the spectators. These awnings at first were red, but afterwards were made of precious stuffs and embroidered.

The theatres of the middle ages owed their construction chiefly to the exertions of Bruneleschi (d. 1444) and Baldassare Peruzzi (d. 1536), who engaged in the painting of decorations and the construction of theatrical machinery, and who developed the rules of perspective drawing. Fernando Francesco and Antonio Bibiena Galli, in the middle and at the close of the 18th century, did a great deal for theatrical architecture and machinery, as also for the decorations; and many theatres were planned by them in Rome, Verona, and Vienna. Servandoni, a Florentine, also gained celebrity in France through his decorations and machinery.

Our play-houses of the present day contain, besides the stage proper, the orchestra, and the spectatory or space for the audience, many other rooms which are necessary to the economy of the theatre. Among these are the manager's office, the treasurer's office, &c., the room for the trial of debutants, the reading-room, rehearsal-room, the library, the wardrobes, the lumber-rooms in which scenery and properties are deposited, the dressing and green rooms, the painting-room, the retiring and refreshment rooms for the audience, and often besides these a large concert-hall, as in the theatre in Berlin, of which we have given the ground-plan in *pl.* 25, *fig.* 1. Here A is the stage, B the spectatory, and C the portico, which also forms a vestibule. D is the concert-hall; E the offices and rooms connected with the management, &c., which go through three stories; F is the covered avenue for carriages, and G the entrances for those who come on foot. The painting-room is situated over the spectatory, and is so arranged that the scenes can be drawn up to the rigging-loft, to be suspended without being

rolled up. The stage is so high that the decorations can be drawn up out of sight without being turned over. Another theatre, which we give somewhat further in detail, is one built a few years ago in Paris, called the *Théâtre historique*. Its concealed situation between the masses of houses D (*fig.* 2) rendered necessary a special entrance from the boulevard; for this purpose the passage C was constructed, which is lighted from above, and the front elevation of which is given in *fig.* 3. *Figs.* 4 and 5 are the two caryatides at the entrance, which represent personifications of Tragedy and Comedy. In *pl.* 26, *figs.* 44 and 45 show the two upper groups, one (44) containing the Cid and Ximene as representatives of the Drama, and the other (45) Hamlet and Ophelia as representatives of Tragedy. As to the distribution of the interior, A (*pl.* 25, *fig.* 2) is the stage; B the parquette with the parterre behind it; E and F are the first tier of boxes; G, the staircases; and H, I, K are the manager's and other apartments connected with the business of the theatre.

As to the proper form which should be given to the portion of the building allotted to the audience, there has been a great deal of disputation. Some wish to make it a complete semicircle; and this form is certainly the most natural, but it affords comparatively too little room. Others propose an elliptical form; to which, however, there are many objections on the score of sound. A form that contains more than a semicircle is very commonly employed, but is disadvantageous, because in it a great number of the best places in the boxes are so situated that only a small part of the stage can be seen from them. The best form would seem to be that of a rather long round arc drawn from several centres, the sides of which open again somewhat towards the proscenium (Ω), and which is so calculated that the first rows of the persons sitting on each side of the first and second tiers of boxes can have a perfect view of both walls of the proscenium. If the boxes, then, have no side-walls, but only columns to support the tiers above them (*pl.* 25, *fig.* 9, side view, and *fig.* 10, front view), and the hinder seats are raised higher than those in front of them, a good view will be obtained from every place. In order to give a clear idea of the entire arrangement of the interior, we present in *fig.* 6 a longitudinal section of the *Théâtre de la Gaieté* in Paris.

We will now offer in a few words what we have to say respecting the erection of a stage.

a. Principal Dimensions. Its size depends altogether on the kind of pieces that are to be performed upon it. A stage destined for the representation of the grand operas with all possible splendor must needs be much larger than one which is to be used for tragedy and comedy; because the choruses, ballets, processions, &c., demand a great deal of space. The width of the proscenium is usually taken as the standard of measurement for the whole stage; and at least double this width is taken for that of the whole theatre from wall to wall, in order that the flats and wings may have the requisite breadth and that the workmen and performers may have plenty of room to move about behind them. The height of the stage-opening should be always at least four fifths of its breadth; and the building must

be as high again above that, in order that the rigging-loft may be properly disposed and that the decorations may be drawn straight up without being folded together. The depth below the stage must be at least from 36 ft. to 40 ft., and in large theatres 45 ft. Even quite small theatres require at least 12 ft., on account of the traps, &c.; but when the depth is so small, the wings can no longer be set on carriages, but must be pushed to and fro by hand, an inconvenience which exists in the theatres of Turin and Naples. The length or rather depth of the stage cannot be determined by positive rules; but it should be at least twice that of the proscenium-opening. Besides this there is the proscenium itself, *i. e.* the space between the curtain, *a*, and the foot-lights, *bb* (*pl.* 25, *fig.* 14). The deepest stages are those of Turin, Naples, and St. Petersburg; yet they have not more than seventeen pairs of wings, or, in technical language, are seventeen grooves deep. When the stage is too deep, the architecture in the back-ground becomes too much reduced by the perspective and gets out of proportion with the figures.

b. The Substructure. The construction of a stage is exceedingly interesting in its details, and next to that of a ship of the line is difficult to represent by drawing. The substructure of a large stage consists of platforms (*figs.* 7, 8, 11, 13), the framework of which consists of sleepers, *a* (*fig.* 11), which rest on stone piers and extend the entire depth of the stage; on these stand the pillars which support the beams for the first story of the space allotted to the machinery. These sleepers lie seven feet apart, but none must lie under the middle of the stage. Above this first platform lies the middle floor (*fig.* 12), on which stand the wing-carriages. The cross-beams have a groove in the direction of their length, in which is inserted an iron rail with a high rim, thus forming a sort of railway for the wheels, *a*, of the wing-carriages (*fig.* 15). From this middle floor the posts are doubled, as between each two of them there stands a wing-carriage, which passes up through the stage. (In *fig.* 15, *d* is the stage.) As the tie-beams of the substructure cannot be bound together by cross-pieces running from front to rear, because the spaces between these tie-beams must be open from top to bottom, they are connected at various heights by strong chains furnished with hooks, which can be removed for a while as occasion requires. The posts, too, are not inserted perpendicularly into the sleepers, but their tops incline one eighteenth or one twentieth of their length towards the rear; because if they stood perpendicular, the sloping position of the stage would have the effect of pressing the whole framework out towards the footlights: the inclined position of the posts, however, averts this evil.

c. The Stage. In a large theatre the stage must be so constructed as to open at any place and still possess the greatest solidity. The stage is composed of panels of pine boards, *a* (*pl.* 26, *fig.* 9, lower view, *fig.* 8, section), each made of three pieces connected together by two battens, *b*; and between the rows of posts there are small trap-doors, *bb* (*fig.* 11), to admit the supporting frames of the shifting pieces or similar objects which are to ascend from below. Thus the entire stage is movable, and only the portion between the line of the curtain and the foot-lights is nailed fast. For the

purpose of allowing objects to sink into the ground and to arise out of it, the floor must open at the places required without the spectators hearing or seeing it, and the adjacent parts of the stage must be as firm as before. For this purpose the following contrivance, represented in *figs.* 6 and 7, is employed. All the panels of one range are slipped into grooves in the tie-beams; but for the last movable panel of each side the grooves slope downwards, so that the panels can be thrust close underneath the fixed part of the flooring, and then pass along horizontally again to the side walls of the theatre. The lever *d* (*figs.* 6 and 7) is so contrived, that when in its place at *c*, it keeps the panel horizontal and even with the rest of the stage; but when it is slipped out, the panel falls to the level of the sloping grooves. Rings are fixed on the under side of the movable panels. If now the stage is to be opened at any spot, a rope is simply run through the ring of the last panel that is to be shifted, and is then carried over the cylinder of the lower windlass, N (*fig.* 3). If by shifting the lever the first movable panel be let fall down to the sloping grooves, then by turning the windlass the last movable panel to which the rope is attached will shove all the rest along, and as many panels will be thrust under the solid stage as are necessary to make the opening required. When the opening is to be closed again, a rope passed through the ring of the first movable panel and over the opposite windlass, N (*fig.* 3), draws all the panels into their places again, so that the last one can again be secured by means of the lever. If there is to be a descent through the stage, the panels are shoved back far enough to admit the platform into the stage; as soon as the descent is made, the panels are thrust back into their places and the stage closed over it. When an ascent is to be made, the panels are first thrust back to form the opening, into which the platform is then raised.

The side-walls of the theatre are lined throughout with boarding, H (*figs.* 1 and 2) in such a manner that an empty space remains, in which the counter-weights, J, of the drop-scenes can play up and down. These counter-weights consist, as is shown in *pl.* 25, *figs.* 24, 25, and 26, of disks of metal *a a*, which, according to the weight required, are stuck on the rod *d d;* and they are attached by the ring *c* to the running-ropes of the drop-scenes. These counter-weights must weigh together the same as the scenes, so that in drawing them up and down there is only the friction to be overcome.

d. The Framework of the Roof. If the framework of the roof of a theatre be not made of iron, as is now usually the case, but of wood, care must be taken to obtain, by employing as little wood as possible, a solid hanging and horizontal framework; since the framework of the roof has to support besides its own weight, that of the various flies and the rigging-loft floor as well as of the drop-scenes, hanging-scenes, &c. An example of an iron roof-framing is furnished in *pl.* 26, *fig.* 26, which represents the roof of the *Théâtre Français. Figs.* 27–31 exhibit its details. Another specimen of iron roof-framing is given in that of the *Cirque Olympique* in Paris (*fig.* 35, and details in *figs.* 36–43); *figs.* 1 and 2 also contain examples of such iron frame-work. The details of a wooden roof-framing are shown in the

longitudinal and transverse sections of the stage part of the Dresden Theatre (*pl.* 25, *figs.* 7 and 8, and *pl.* 26, *fig.* 3).

The framework of the roofs of theatres must be much higher than that of ordinary roofs, and must also be more strongly tied together, because they have also to support the flies F, G, H (*fig.* 3), which are ten feet apart. Sloping-roofs are here to be avoided, because they greatly contract the space at the back part of the stage, the very place where the greatest machine effects are to be produced. Over the tie-beams is extended the rigging-loft floor (*pl.* 25, *fig.* 12), on which stand the windlasses and drums A and B, of which an end view is given in *fig.* 30. From these tie-beams are suspended the permanent flies G, H, and F (*pl.* 26, *fig.* 3) and the temporary ones D, which are put up only for occasional purposes, by means of suspension-joists or *tongs* as they are called. The rigging-loft floor itself consists of beams seven inches by five in thickness placed on edge at a distance of two feet nine inches apart, and covered over with planks as occasion requires. These beams, however, are not made fast, but fit into grooves; so that when necessary, they can be removed for the purpose of admitting large objects through the rigging-loft floor.

e. The Wings and Wing-carriages. By *entrance* we understand the opening between two sliding-scenes or wings which bound the scene on each side of the stage. When the theatre is designed to be large and convenient, the entrances must be at least six feet broad; this gives room enough for the carriages, and if the drop-scenes are suspended to the tie-beams of the roof at a distance of twelve feet apart, two changes of scene can easily be prepared one behind the other. The wing-carriages serve both to support the side-scenes or wings and as means for running them out and in. Such a carriage (*pl.* 25, *fig.* 15) consists of a sill *a*, into which are mortised four uprights *b b b b*, joined together two and two, and long enough to extend down under the stage. Above are the head-rails *d*, which run in the grooves of the stage and keep the carriage from being overturned. In order that the carriage may run easily, it has two bronze wheels at the bottom deeply channelled, which run over the high-rimmed iron rail described above, or projecting wheels running in a deep groove. At each end of the sill *a* is fixed a spring-hook, to which the rope of the windlass is attached by means of a ring, when the carriage is to be run out or in. Besides the regular wing-carriages, there are other carriages which run on the same floor and on which shifting pieces, &c., are placed. These carriages are usually brought under the trap-doors (*pl.* 26, *fig.* 11), and objects can be run upon them across the stage.

f. Wing-Ladders. The wings when about to be used are fastened to large wing-ladders (*pl.* 25, *fig.* 15); these consist of two uprights *f f*, which are connected together by rails above and below, and are prolonged at the lower end so as to extend almost half way into the wing-carriage, and below, where they are weakest, are strongly cased with iron. For the purpose of getting easily to the top of the wing, each frame has a light ladder *g* attached to it. Another sort of light wing-ladder is represented in *fig.* 16; *fig.* 17 exhibits a front view as seen from the stage of three wing-ladders, *f*, fastened

in their carriages; *fig.* 18 gives a bird's-eye view, and *fig.* 19 a section on a larger scale.

The frames for the drop-scenes are of like construction, but are much stronger and furnished with braces in every direction. Frames are introduced for practicable doors and connected with the framework of the whole. The stage curtain is also attached to such a frame; but in recent times curtains of tin plate or frames of wire-work have been made; so that in case of fire the stage may be instantly cut off from the spectatory. *Pl.* 26, *fig.* 32, represents a curtain of this description in the *Théâtre St. Marcel* in Paris; and *figs.* 33 and 34 give the details, from which the construction and mode of joining together the ribs of the curtain frame can be readily understood.

All the drop-curtains have from eight to ten loops fastened to the top-rail of the frame; and to these rings are attached, by means of which the curtains are suspended on the hooks (*pl.* 25, *fig.* 23) which are fastened to the tie-beams of the roof. When a drop-scene is to be made use of, the halliards of the scene are fastened by a slip-knot to these loops. The hanging-scenes or borders have no frames, but are nailed on to single rails or *battens*, which are also provided with loops like the drop-scenes.

Another kind of loops are those used for perforated drops, exhibiting *e. g.* colonnades, clumps of trees, &c., through which the actors have to pass; and it is often very difficult so to contrive these frames that they may have the necessary firmness, as they must never be visible. So too the frames for those pieces which by means of small trap-doors are to rise as it were out of the ground, are very difficult to construct, as they have no upper rail, and cannot be fastened in any other way at the top. Hence these frames, especially when they extend across the whole head of the stage, are usually very heavy. *Fig.* 22 shows a combination of wing-carriages which serves to transport those pieces which are carried across the scene through the traps. *Fig.* 20 is a side-view, and *fig.* 21 a section of one of the metal wheels in the sill.

g. Machines. In a theatre there are a great many machines, which are situated partly in the space beneath the stage and partly above it in the flies and rigging-loft. To these belong, *e. g.* the *drums*, which consist of two large disks connected by a common axis, and to the circumference of which strips of board or laths are nailed extending from one to the other. The uses of these drums are very various, for they are distributed about all parts of the loft and cellar. One application of them is for shifting the scenes. For this purpose there is placed under the middle line of the stage (*pl.* 25, *fig.* 11 *c c*) a large cylinder (*pl.* 26, *fig.* 3 M), which begins at the orchestra and extends to above the sixth pair of wings; at the end of this is placed a second, and, when the theatre is large, a third cylinder. Parallel with this there stands on each side one or two other rows of cylinders (*pl.* 25, *fig.* 11 *b b* and *d d*, and *pl.* 26, *fig.* 3 N N). On these cylinders or shafts the drums for the ropes are fastened, and the shaft in the place where these are is left square. At the ends the shafts, as shown in *figs.* 13, 14, and 15, are cased with iron rings, and iron gudgeons *a d* are driven deep into the shaft

and secured with the wedge *c* (*fig.* 15). By these gudgeons the shaft rests on its bearers; although when it is long, it is supported at one or more places in the middle. In order to facilitate its working, metal friction-wheels (*pl.* 26, *fig.* 20, bird's-eye view, and *fig.* 21 end view) are everywhere employed. Between the ends of the drum there are several other disks for the support of the laths or staves which form the mantle of the drum; and strong ends of rope with rings are fastened inside to the shaft and pass out through the mantle, to which the halliards are fastened by means of spring hooks. In the middle floor (*pl.* 25, *fig.* 13) the drum-shaft runs along the middle over the other shafts; and these drums serve the purpose of shifting the panels of the stage or of working the tackle for the ascent of objects out of the ground. Several drums are also placed on the rigging-floors, but of different diameters, which serve for raising the drop-scenes and borders, for wafting cars and persons through the air, &c. The diameter of these drums must be accurately adapted to the distance which the drop-scenes, &c., have to go in a certain time and in a certain number of revolutions. The drums which are placed in the rigging-loft, and which mostly serve to control the motions of the counter-weights of the drops, need not be of any great breadth, as the rope of the counter-weight is merely passed once or twice round the drum in order to increase the friction, so that its motion may be quickly checked. But while the shaft below the stage, by means of a rope passed over its cylinder, moves all the drums at once, here each one is moved separately, and consequently each must be provided with a wheel and hand-spikes. *Fig.* 30 exhibits such a windlass-frame from the side, and *fig.* 29 from the front; *d* is the wheel, and *g* the cylinder round which the rope of the counter-weight is passed. In *fig.* 28 the construction of the wheel is shown. *Fig.* 27 shows the fastening of the frame to the floor of the flies.

We have stated above that loops furnished with rings are attached to the drops, by means of which they are suspended to the hooks of the tie-beams (*pl.* 26, *fig.* 17) when not in use. When a drop-scene is to be made use of, lines which are of properly adjusted lengths and furnished with spring-hooks, are made fast to these loops. Each of these lines before it reaches the halliards goes up to the collar-beam and over the roller *e* in the roller-case *b* (*fig.* 16), which is fastened to the beam *a*; so that these lines can never get entangled, although their length equals the entire height of the drop-scenes. Such roller-cases are distributed all along the collar-beams, as shown in *fig.* 18; similar ones too are required for the borders, although these (*fig.* 19) may be of a much lighter construction.

In order to cause objects to ascend through the trap-doors, another contrivance must be added to the carriages (*pl.* 26, *fig.* 2 *KK*); for in that case the frames are to be elevated while the carriages remain under the stage. For this purpose the uprights of the carriages have a head-piece attached to them, of which *pl.* 25, *fig.* 31, shows a front, *fig.* 32 a vertical, and *pl.* 26, *fig.* 12, a side view. The uprights have in them a deep dovetail-shaped groove, in which a sliding-rail moves up and down, and on this the piece is fastened. In the inside of the groove there are two channels, one on

each side of the rail, in which the halliards *b b* run; these are fastened to the foot of the rail, and pass over the rollers *c c* in the head of the carriage, from which they go to the windlass. When the halliards *b b* are drawn tight or slacked up, the rail with the shifting-piece must rise or fall.

h. The Illumination. Until quite recently, and even at present with but few exceptions, the stage has been lighted by means of argand oil-lamps, arranged partly in front of the proscenium along the orchestra, and partly behind the frames of the side-scenes, and above and in front of the drop-scenes. When isolated lights are needed, as *e. g.* for the moon and such like appearances, they are placed in closed boxes, so as to give no light from the sides.

When the foot-lights consist of oil-lamps, the lamp ladder is a movable trap; when night is to be produced, it is let down below the stage. Changes of light to imitate sunset or moonlight are produced by mediums, which are provided with red or green glass, or similar colored silk stuff; these are usually kept below the stage, and are raised by a separate contrivance to such a height as to shade the light of the lamps. The lamps at the wings are ranged one above the other, and before them is placed a half cylinder (*pl.* 26, *fig.* 4), in which the space between every two lamps is divided into four parts. One of these parts is entirely open for imitating daylight; the second is entirely closed for night; the third is shaded with red for sunrise and sunset; and the fourth is shaded with green for moonlight (*k* and *l*). This half cylinder works up and down at *m* on long pintles, and is raised by machinery, which is also connected with the foot-light ladder, to such a height as to bring that part of the cylinder before the flame of the lamp which corresponds to the light of the foot-light medium. In many theatres there are only three divisions in the half cylinder, black, green, and red, and for daylight it is thrown back, a contrivance which is certainly superior to the other.

In the better class of theatres, however, gas is now employed for lighting the whole stage, and is likewise introduced into the great chandelier of the spectatory; this has great advantages over the old mode. In this mode of illumination the gas passes first from the gasometer to the place of the inspector, or of some one charged with the matter, and from there it is conducted through various sets of pipes to the gas-ladders, the lights above the stage, and the great chandelier. The main pipe from which all the other pipes proceed is furnished with a graduated cock; and the director is able, by partially cutting off the gas, to gradually reduce the entire illumination from the greatest brilliancy to almost total darkness, so that for the purpose of imitating night no other contrivance is necessary. Accordingly, as is shown by the section of the gas-ladder (*pl.* 26, *fig.* 23), the lamp *c* with its support *b*, and the gas ladder *a*, are fixed to the beam *g* of the stage, and only the shades for changing the quality of the light, *a b c* (*fig.* 22), are raised and lowered as occasion requires. The lighting of the side-scenes occasions rather more difficulty, on account of the wing-carriages being movable. *Fig.* 4 contains a front view and *fig.* 5 a section of the contrivance here employed. The supply-pipe hangs above on the right corner

of the carriage along with the feeding-pipe, and consists of four shanks, *f f g h*, which are connected together by perforated air-tight joints. When the carriage is drawn back, as here represented, the shanks lie close together; but when it is pushed forward, they form a right line. A very similar contrivance is applied to the great chandelier, being placed above the ceiling of the spectatory, so that the chandelier can be raised for the purpose of lighting the lamps, and then lowered again. The intensity of its light is constantly the same with that of the stage-lights; for the gas comes to it only as regulated by the superintendent. The lamps employed for lighting the stage overhead are fixed like the foot-lights. Movable lights are inclosed in cases, as shown in *fig.* 24, which represents the section of such a case. The case is suspended at *e*, and has at *a* and *d* a disk of glass, by means of which the light can also be colored. The lamp *b* receives its gas through a flexible caoutchouc or gutta percha pipe. The light of the wing-lamps is colored, as represented in *fig.* 25, by a turning-shade *f*, which is colored alternately green and red, the proper color being brought before the flame of the lamp by raising the whole shade. Gradations of color are obtained by turning the shade more or less forward.

TECHNOLOGY.

PLATES X. 1—35.

INTRODUCTION.

THE first effort of man is to procure his food and the most indispensable necessaries of life; when these are supplied he endeavors to make his existence more comfortable, and to obtain various physical and mental enjoyments. For the attainment of these objects a great variety of different kinds of labor is required, which are sometimes quite simple, but more frequently complicated, requiring much knowledge and skill. The totality of knowledge by which we learn to transform and prepare the products of nature, the raw material, so as to serve for the use and pleasure of man, we call *Industrial Science* or *Technology*. In other words, technology comprises the knowledge of the various arts and manufactures by means of which the different materials are adapted to our uses, and the knowledge of all the substances and auxiliaries which serve for that purpose. It is evident that the field of Technology is one of vast extent, there being no branch of human industry into which it does not enter.

However crude technology must have been in its beginnings, being at first limited to the preparation of food, the construction of secure dwellings, and the manufacture of arms and clothing, it has yet risen to a high degree of development in the course of centuries. While the first inhabitants of the earth were content with a rude preparation of the products of nature, using only the power of their hands, we call to our aid the elementary forces of nature, and have subjected them to our rule; the most sagacious discoveries in mathematics, physics, and chemistry, the experience of centuries and the most distinguished results of human ingenuity are united for the purpose of saving power, time, and human labor, while at the same time the results are more perfect than it is possible for them to become by mere manual labor. The knowledge of those implements and machines which have been invented for working raw materials constitutes therefore one of the principal branches of industrial science. In order to treat of the latter in its full extent it would be necessary to compile a voluminous work with countless plates. This, however, could not be the design of the present treatise, which only forms a subdivision of a more comprehensive work; and we have therefore selected the most important and interesting

subjects and discussed them more at length, in preference to giving something of all without treating fully of any.

One of the principal means of advancing civilization is facility of communication, by which men are brought together and the products of one region are speedily and safely transferred to another; the interchange of ideas as well as the exchange of the productions of nature and industry being thus promoted and facilitated. We therefore place at the head of our treatise the means of communication.

I. MEANS OF COMMUNICATION.

Means of communication include the construction of highways on land and water. The welfare of a state is greatly promoted by a well regulated system of roads and inland navigation, and it is easy to discover the difference in the civilization, industry, and general opulence of two countries, in one of which communication in all directions is made easy and convenient, while in the other cities and villages are in a measure isolated by the bad condition or want of highways. How much has been effected in this respect by the construction of railroads in the greater part of Europe and in the United States need scarcely be mentioned. We will now proceed to consider the different kinds.

1. The Construction of Roads.

The natural surface of the ground, unless it be rock, when used as a road, is soon brought to such a condition by the action of the weather and of vehicles as to offer great obstacles to convenient communication. On this account artificial roads have been constructed since very ancient times, and remains of such which have been preserved to the present time show how carefully and judiciously they were designed. The first highroads of which we have any knowledge were built by Semiramis, and one of them led from Susa to Sardis, a distance of 2100 miles. The Carthaginians also had artificial roads, and the oldest in China were built so durably as to be still available. The Greeks, especially the Athenians, constructed excellent roads, particularly for their religious processions, as for instance the sacred road of Eleusis, and that to Delphi; there was also such a one near Cyrene.

The Romans, especially in the reigns of Augustus, Vespasian, and Trajan, constructed causeways from the city of Rome to all parts of the empire, however difficult the ground, all of which radiated from a central column (*milliare aureum*) and were divided into miles of eight stadia each. They were built with extreme care, and remains of these Roman roads are found in almost all parts of Europe. They have below a bed of mortar (*substratum*) of about one inch in thickness; on this rests a stratum ten

inches in depth, of flat stones (*statumen*) laid in mortar and breaking joints, which serves as a support for the second stratum of 8–10 inches, composed of concrete (*rudus*) or small pebbles cast in cement. The third layer consists of a mass of lime and brick-dust (*nucleus*), on which finally was placed a stratum of gravel or a stone pavement (*summum dorsum*). In this way the body of the road was something over three feet in depth. Besides these roads they had others of less importance, consisting of two gravel-ways twenty feet in width.

In the middle ages the Roman roads were suffered to fall into decay, and no new ones were constructed except in France by Queen Brunehild, for which reason causeways are even now called *chemins brunehauds* in Belgium. In modern times causeways were first built in Holland, and subsequently in Spain, England, Germany, and France.

A. Streets in Cities.

Streets in cities are paved with stones almost without exception, and only in some cities the streets in the suburbs are made in the manner of causeways as we shall describe them below.

The paving of streets may be done in two ways; that most commonly in use is represented on *pl.* 1, *fig.* 5. There are others, however, constructed in the manner shown in *fig.* 3. Every street should have side-walks along the houses (*figs.* 3, 4, 5, 6) from three to eight feet wide, covered with flags of granite, or paved with bricks; the latter, however, should only be used where nothing better can be obtained. Some years ago asphaltum was very much advocated; it was mixed with very fine gravel and spread in a semi-liquid state over the side-walks, when after cooling it presented a smooth surface similar to granite. The idea was soon given up, however, as the wear of the asphaltum was very great, and it became soft in very warm weather.

The carriage-way of the street should be elevated in the centre (*fig.* 3) and slightly arched, so as to turn the water to both sides, where it runs off more readily in gutters (*a*, *fig.* 3, and *g*, *fig.* 5), which must have a longitudinal descent. In cities provided with sewers which run along under ground usually in the middle of the streets, and carry off the rubbish from the houses as well as the water from the streets, the latter may be much less arched; the gutters are in that case provided with conduits covered with grating, through which the water enters the sewers; these also have openings through which they may be entered from the street and cleaned.

In places where the soil is firm and the seasons generally dry, the pavement itself may be made in the manner shown in *pl.* 1, *fig.* 3 being a section, and *fig.* 4 a ground-plan. Here the tracks of the wheels only, *c c* (*fig.* 3), and EF (*fig.* 4), are laid with closely fitted stones, and the spaces *b*, *d*, and *b* (*fig.* 3) are covered with well-rammed gravel. In most cases, however, the pavements are made as shown in *figs.* 5 and 6, where the whole street is paved with round stones (pebbles) fitted together as closely as possible. The wheel-tracks should in any case be laid with flat stones,

ff (*fig.* 5), and the spaces *ee* paved with small pebbles, on which the horses have a safer hold. Sometimes long stone sleepers are employed for the wheel-ways, jointed together as seen at *figs.* 7 and 8. Another mode of joining the stretchers, by Mathews, is shown in *fig.* 9, by which not only the lateral displacement but also the lifting of the ends is to be prevented. This is effected by the introduction of a key-stone, *d*, which may either be shaped as in *fig.* 10, *cde*, or else as in *fig.* 11, *cde*.

In order to avoid the disagreeable noise and diminish the dust attendant on stone pavements, it was proposed in England and France to use instead of the paving-stones blocks of wood of equal size, placed with the transverse section of the fibres on the surface.

This idea was favorably received, and trials were made by paving whole streets in this manner, on which, however, many drawbacks and imperfections became apparent, the most important among which were the great cost and the action of moisture, which by swelling the wooden blocks deranged their position and destroyed the pavement. On this account wooden pavements have gradually disappeared, but they are frequently applied in passages, covered ways, and stables, where they are found to answer very well. There are many different modes of constructing wooden pavements, and we will proceed to consider some of them.

The simplest kind of wooden pavement consists of cubical blocks of wood placed so as to break joints on an even and firm foundation of sand, and firmly pressed together by a curb-frame; but such a pavement is too much affected by changes of temperature and moisture to remain in order long, and with any unequal yielding in the foundation it will become uneven. It was therefore proposed so to shape and arrange the blocks as to support each other, similar to the voussoirs of an arch. Of this kind is the pavement represented in *pl.* 1, *fig.* 21 *b'*. It consists of blocks of wood (*fig.* 21 *a*) the tops of which are regular hexagons, as the dotted lines *bb'* (*fig.* 21 *a*) show, while the lower sides are irregular hexagons of three long and three short sides, *a* and *a'*. *Fig.* 21 *a* shows how according to this construction the sides of the blocks form warped surfaces, which, when the blocks are arranged as in *fig.* 21 *b*, will hold and lock them in such a manner that no single one can be removed. Grooves are cut into the upper surface in order to afford a safe footing for the horses.

Arranged on a similar plan is the construction of Laves of Hanover. *Fig.* 13 represents a walk for foot passengers; *fig.* 12, a carriage-way; *fig.* 14 is a cross-section and *fig.* 15 a longitudinal one of the latter. Here the wooden blocks rest on the cross-sill *c* and the longitudinal beams or sleepers *a* and *b*; their upper surfaces are regular squares, while the sides are cut obliquely in different forms, and in such a manner that the several prisms form, as it were, voussoirs of a flat arch, which are held immovably against each other by a key-prism. The latter is fastened by screw-bolts to the sleepers. When the pavement gets wet and the prisms swell, the pressure which they exert upon each other, and which otherwise raises the pavement in the form of an arch, is thus directed downwards, in which direction no displacement is possible.

An improved construction has been sometimes used, which is shown in *pl.* 1, *figs.* 16–20. Here we have first a substructure, which of itself is a wooden pavement, through which, however, the moisture that penetrates from above is drained off into the bed of sand below. *Fig.* 16 shows this substructure, which can be conveniently taken up when water or gas pipes, &c., are to be laid. Two or more sills are placed lengthwise at suitable distances from each other and united at intervals by cross-ties. On these sills rest short pieces of plank, *a a a*, bevelled at both ends in opposite directions (*fig.* 17), the piece *d* remaining, however, which prevents the pieces of plank from being pushed closely together, thus leaving the interstices *c c c* (*fig.* 16), which serve as drains. Those pieces which abut against the curb of the pavement (*fig.* 16, left side) are fastened to the sill. No further fastening is required, as any pressure acting on the substructure will only serve to bring its several parts more closely together. The prisms for the pavement itself are made of various forms, some of which are represented in *figs.* 18, 19, 20, and 21. Of these *figs.* 18 and 19 show a pavement which is very suitable where the ascent is considerable and the horses require a very secure footing. The perspective view (*fig.* 19) shows the form of the single blocks as well as the manner in which they are alternately so placed as to afford a firm step both in ascending and descending. *Fig.* 21 shows a combination of blocks which also forms a very firm pavement. They are truncated pyramids, alternately inverted, and two such courses will support themselves entirely.

Great attention is at all times to be bestowed on the cleanliness of streets, and especially of wooden pavements, but the cleaning when done by human labor is too expensive and slow. Many attempts have been made in England and France to perform this labor by machines, and one of the most effective of these is represented in *fig.* 27. It is a street-cleaning machine made by Whitworth & Co. of Manchester, where as well as in London it has for some time been successfully in use. Two horses with a driver can work with a machine of the dimensions given below with a speed of 100 feet per minute, and thus can sweep thoroughly in one hour 120 yards of a street 50 feet in width.

The machine consists of a cart provided with an apparatus which sweeps the street, and carries the dust and rubbish into the interior of the cart, when it is moved. In this consists its superiority over other machines of this kind, which only move the dirt aside, and leave it to be carted away separately. It operates equally well on all kinds of pavements and roads.

The machine represented in *fig.* 27 consists of a two-horse cart, A, of ordinary size, with two large wheels, B; the body of the cart hangs low between the wheels, and consists of two parts, the lower one of which can be taken off when full and exchanged for another. For this purpose it is suspended by chains passing over pulleys, K. Both pulleys are on the same axle, which also carries a cog-wheel that is moved by an endless screw, which may be turned by a crank or key in a place accessible to the driver. In this way the lower part or box which, when in use, is fastened by bolts, may be exchanged for another when required, and thus when the place of

deposit is at a distance, the full boxes may be left and afterwards carried off together in a frame-cart. Through the bottom of A passes a pipe, the upper end of which reaches a little above the top of the full load of solid dirt; in the cart the fluid and solid parts will separate, and the former may be drained off into the sewers by opening the bottom of the pipe.

At the top of the back part of the cart there is an axle movable in fixed bearings, carrying two pulleys, D, of 1 foot diameter, at a distance of 3 feet 4 inches apart; outside of these pulleys movable about the ends of the axle are two light wrought-iron frames, which carry at their lower ends the bearings for another axle, on which also two pulleys, E, are fixed. Round the pulleys D and E pass two parallel endless chains, F, on which are fixed, at regular intervals, thirty rows of brooms, 3 feet 4 inches in length. On the top of the frame is a light cover of sheet-iron; below is a wide trough resting with its upper end on the top edge of the lower cart-box. On the axle D there is finally a pinion into which works a large cog-wheel on the inner face of one of the cart-wheels; and thus when the cart is drawn by the horses the system of brooms is made to move in the direction of the arrows, each broom successively touching the street and carrying the dirt up the trough into the box. When the lower box is to be changed, or the full cart is to be drawn away, the whole broom-frame is raised into a horizontal position. For this purpose it is provided with the sector, I, over which passes a chain that winds up on the pulley H; the latter is also moved by a crank, endless screw, and cog-wheel. On the axle of H is another pulley, over which also passes a chain, to the end of which weights may be applied in order partially to balance the weight of the broom-frames, and thus to regulate the pressure used in sweeping. An apparatus for counting the revolutions may also be attached to the axle D, which is advantageous when the work is contracted for by the square yard.

B. Roads.

Roads connecting places of importance, and forming the great arteries of the country through which they pass, are constructed with great care; they are regularly graded, drained, secured from inundation, and covered with gravel or broken stone, so as to be easily and safely travelled at all seasons.

The grade of a road, *i. e.* its inclination to the horizon, should in no place be so steep as to require heavy wagons to take additional teams, or in descending to lock their wheels; it should not exceed 3–5 per cent. The road should be sufficiently wide to allow two wagons to pass each other conveniently without encroaching upon the foot-way; the width of the roadway should therefore be at least 24 feet. In regions subject to inundation, safety requires that the road should be above the level of the highest water, and guarded against its pressure by bridges and breakwaters. In order to allow the rain-water to run off rapidly, a transverse convexity is given to the road-way, *e f i m* (*pl.* 1, *figs.* 1 and 2); the footpaths *d e* and *m n* should also have a slight lateral slope towards the side-channels. The depth of the latter is 3–4 feet, and when the road is on a

level with the adjacent ground, as in *fig.* 1, the slopes of the side-channel *a b c d* may be 1 base to 1 perpendicular. When the road is on an embankment, as in *fig.* 2, its side slope should be $1\frac{1}{2}$ base to 1 perpendicular, and the same slope, or even a less inclination, is required for the sides of excavations. The bottom *b c o p* of the drains is two feet in width. At intervals walled drains, termed *culverts*, built of stone or brick, and usually arched at the top, pass under the road, and convey the water to the main drains which communicate with the natural courses. Shade-trees should not be planted on the road itself, as they are apt to keep it damp.

When a road is to be made, the country through which it is to pass is carefully surveyed and mapped; profiles of the surface are obtained by means of the spirit-level, and from these data the location of the road is determined on, and estimates made of the required structures, such as bridges, culverts, and side-walks, and of the number of cubic yards of embankment and excavation. The line of road being thus marked on the ground, the grading and draining are done according to the plan proposed; on each side of the road from 3 to 6 feet are marked off for the footpaths *de* and *mn* (*figs.* 1 and 2), and two rows of curbstones placed at *e* and *m*. The paved bottom road covering (*fig.* 1) is formed of three layers of stone. The bottom layer, *h*, consists of small blocks of stone, about 6 inches high, packed together as closely as possible, the interstices being filled with small stones compactly set with a hammer. The second layer, *g*, of broken stone, is made four inches high, and the convexity of the carriage-way is begun to be formed. The third layer, *f*, should consist of the hardest broken stone, of the size of a pigeon's egg, and should again be from 4 to 6 inches high. A coating of clean gravel, two inches thick, termed a *binding*, is spread on the surface, and levelled by means of a road-roller. The elevation of the centre of the carriage-way is about one eighteenth of its width. The foot-paths are also covered with gravel, and serve as abutments for the body of the road.

In order to diminish the wear and tear of the road as well as of the conveyances, *summer roads* are sometimes laid out on the sides of stone roads. They are not covered with stone, and are closed by gates in wet weather and in winter.

The materials for a good road-covering are the harder kinds of stone, quartz, the scoriæ of iron-furnaces, poor iron-ore, &c. Sandstone and all kinds of slate are too friable for the purpose. In Holland the so-called klinker roads are made, which are covered with brick baked very hard, called *klinkers*.

Another mode of forming the road-covering was first brought into notice by McAdam; roads made according to his system are called *Macadamized*, and have been adopted in many states on account of the economy in their first construction. *Pl.* 1, *fig.* 2, represents a road of this kind; the covering consists entirely of broken stones, those of the bottom layer being about as large as hens' eggs, and those on top of the size of a hickory-nut; gravel when it can be procured is preferable for the top-coating. Roads of this kind will only answer when the subsoil is very firm; they require much care during the first years, as deep ruts are readily made, which must be

constantly filled up, but after some time the whole mass will attain a high degree of compactness and durability.

We have mentioned above that after the superstructure of stones is spread on the road, it is pressed and smoothed down by a road-roller. Formerly huge cylinders of granite were employed for this purpose; the axle, which passed through the centre, rested on bearings in a square frame, which was drawn by ten or twelve horses. In modern times cylinders of cast iron are used, and we will notice two of the various forms which have been given to these rollers.

The road-roller of Schattenmann consists of a hollow cast iron cylinder of 4 feet diameter and 4 feet width. On each side is fastened by screws a cross of cast iron, through the centre of which the axle passes. On the ends of the axle rest cast iron bearings which are attached to the under side of the frame which carries a box 6 feet long, 5 feet wide, and 2 feet high, capable of being loaded with three tons of stone. Attached to the frame are two scrapers of plate iron, two brakes which can be pressed against the cylinder by screws, and four rings through which levers can be pressed to prevent the roller from upsetting on inclined grades or very soft ground. At each end of the frame is a pole and below it a runner, in order to be able to reverse the motion without turning the roller round. The cast iron cylinder with arms and axle weighs about two tons, the frame and box about one ton, and, by loading the roller, the weight of the whole may be increased to six tons. *Pl.* 1, *fig.* 22, is a side view of this machine, and *fig.* 23 a part of the section of the cylinder with its arms and axle. A is the cylinder, B the frame, C the box, D the brakes, E the adjusting screws for the same, F the scrapers, G the runners, H the poles, shown in part, I the arched floor of the box, K the bar supporting the latter. The roller is drawn by six or eight horses, and is at first passed over the road several times without additional load, after which the box is gradually loaded to the full extent. In one working-day 2,500 sq. yards may be worked in this way; the road must be kept moist, however, the whole time.

The road-roller by Schæfer is loaded within the cylinder. *Fig.* 24 represents a side view of it, *fig.* 25 a section of the cylinder, and *fig.* 26 a horizontal section of the whole machine. The axle rests in bearings on the frame EF, to which the pole B is attached. In the interior of the cylinder is a hexagonal system of boxes, *i*, *i*, *i* (*fig.* 25), which are held by the arms *f*, *f*, and the knees *d*; these boxes or cells are loaded when required with bars of lead or iron, through the openings *m*, *m*, which are closed by covers and bars, *b*, *b* (*fig.* 24). This roller has the advantage that the axle and frame are not loaded as much as in the preceding one, the pressure being more immediately upon the road; the axle may therefore be of less diameter, and less force will be required to move the roller.

C. Tunnels.

Tunnels are subterranean roads which are excavated through mountains, under rivers, or under structures, in order to avoid the obstacles presented to their passage on the surface. The ancients appear to have made tunnels

at early date, for in Babylon an arched way 500 feet long, 15 feet wide, and 6 feet high, passed under the bed of the Euphrates connecting the two palaces. The grotto of Pausilippo near Naples is also a structure of this kind. In modern times tunnels have been excavated in most civilized countries. In Germany we name the tunnel near Tübingen in Wirtemberg, by means of which the river Ammer is carried through the Oesterberg; also the tunnel near Reichenau in Austria, 1,362 feet long, and 3,700 feet above the level of the sea, through which a stream is made to pass for the purpose of floating wood to Vienna. In France the canal of Languedoc is carried through a mountain. Between Gravesend and Rochester in England is a tunnel of about two miles in length, through which passes a canal connecting the river Medway with the Thames. The Bridgewater canal passes through a tunnel near Manchester, and various other tunnels for similar purposes exist in England. Of Railroad tunnels we shall speak below.

The most remarkable tunnel is the celebrated Thames tunnel, of which we have given representations in *pl.* 1, *figs.* 28–34. It was built by Sir I. Brunel, a French engineer, who on seeing a ship's keel hollowed out entirely by the worm, had conceived the idea that a large tunnel might be made by driving a number of small tunnels close to each other. For this purpose he constructed his so-called shield, of which a single field is represented in *fig.* 33. These fields, of which there are twelve in all, as *fig.* 31 shows, consist of the bottom-plates, *f*, *f*, the side-faces, *d*, composed of several pieces, and the top-plates, *c*, *c*; each has three compartments, in each of which a man can work erect. The openings in the side-plates allow the workmen to assist each other. The forward face of the field is composed of a number of iron plates, *a*, *a*, 6 inches wide and 2 inches thick, each of which is supported by two screws against the side pieces, when the shield is placed against the earth wall that is to be perforated. The earth is thus sustained while the shield itself abuts at its head and foot plates against the masonry, and can be moved forward by screws. *Fig.* 32 shows this plainly. When the work is to proceed each workman takes out one of the foot-plates, *a*, and removes the earth immediately before it to exactly the depth of 6 inches, after which he inserts the plate again and presses it firmly against the new wall by means of the screws. He then takes up the next plate and proceeds as before, until he has pushed forward all its plates, when six inches will have been gained on the whole face of the tunnel, and the shield can be moved forward by that amount. The newly gained space is immediately closed by the arches (*figs.* 31 and 32), while the thirty-six workmen in the shield proceed to excavate another 6 inches. In this manner the pressure of the earth is supported at all times, except at the small spaces where the earth is just being moved, and these may be closed at once should any portion suddenly give way. The form and dimensions of the arches are shown in *fig.* 31.

The success of the work is wholly due to the use of this shield and Brunel's unflinching perseverance. The shield, which is entirely his invention, has been set up by the proprietors of the tunnel as a monument in honor of the distinguished engineer.

The tunnel is situated between Wapping and Rotherhithe (see the plan, *fig.* 28) at the only point between London Bridge and Greenwich where it could be driven without endangering the foundations of the bridges across the Thames. The banks of the river at this place are but 1200 feet distant from each other. Formerly it was necessary to make a circuit of four miles to pass from one side of the river to the other.

The joint-stock company which constructed the tunnel was formed in 1824, and the work was commenced in the following year by the construction of a cylinder of brick, fifty feet in diameter, three feet thick, and forty-two feet high, on the Rotherhithe shore, 150 feet from the river. This cylinder rested on a cast iron ring, sharp on its lower edge, and its masonry was well connected by iron rings and anchors. On its top was erected a steam-engine of thirty horse-power for the purpose of elevating the earth and water from the excavation; the earth being dug away from under the cylinder, it gradually descended until in this manner a walled shaft of sixty-five feet depth was obtained; a second shaft eighty feet deep was sunk in the first one, to serve as a reservoir for the water. The tunnel commences at a depth of sixty-three feet; it was excavated thirty-eight feet wide and twenty-two and a half feet high, as it was to afford room for two arches, each fifteen feet high, and having a footway besides the carriage-way (*pl.* 1, *fig.* 30). The entrance to the tunnel from the shaft is shown in *fig.* 34. The excavation of the tunnel was commenced on the first of January, 1826. For every foot in length about 45–50 tons of earth were removed and delivered at the head of the shaft by the steam-engine, and 5,500 bricks were required for the masonry. Although the tunnel descends about three feet in every hundred, yet it approaches the bed of the river near the middle to within ten feet (*fig.* 29). Still no accident happened until the 18th of May, 1827, when at a distance of 544 feet from the shaft the water broke in with such violence that within fifteen minutes the tunnel was filled with water and about 1,000 tons of sand. On examining the break with the diving-bell it was found that the arches had not been damaged, and that the shield remained in its place. The break was filled with 3,000 earth bags, each containing a ton of clay, and the water being pumped out, the work was re-commenced in September, but progressed very slowly, as the workmen were much inconvenienced by fire-damp, and the work was often dangerous. Fifty-two feet more were completed when, on the 12th of January, 1828, the water broke in a second time and filled the tunnel in ten minutes. On this occasion six workmen lost their lives. This break having also been closed by means of 4,000 tons of clay in bags, the water was again pumped out; but the work stopped here for want of funds. Seven years afterwards, when government agreed to advance all the funds required, the work was taken up again, but progressed very slowly on account of the difficulties of the ground. Three more breaks also occurred, but one life only was lost. In January, 1841, the tunnel had reached the opposite bank, a distance of 1,140 feet, and on the 13th of August of the same year Sir I. Brunel walked for the first time below the Thames from one shore to the other. On the 25th of March, 1843, the

tunnel was completed with the exception of the descending road for the carriages, and was opened for foot passengers. The carriage road on each side is forty feet wide and descends fifty-seven feet in two turns of a spiral of 200 feet in diameter, the grade being thus very moderate. The archways are lighted by gas, and the temperature in them is but little different from that of the open air.

The whole cost of the work, originally estimated at $800,000, amounted to $3,000,000, on account of the breaks and many other accidents; and the excavation and removal of a cubic yard of earth cost on the average $16. According to a moderate estimate the income of the tunnel amounts to $100,000 annually.

D. Railroads.

Roads with wheel-tracks of large blocks of dressed stone closely fitted were used early by the Egyptians and Indians in order to transport with more facility the great burdens they used in their structures, and a stone road of that kind led from Palmyra to Baalbec through the desert. The Romans had similar stone-tracks, for which they used granite, porphyry, and syenite; but still the blocks were frequently crushed by the immense loads transported over them, and on that account stone-tracks gradually fell into disuse.

About 300 years ago the first wooden railroads were built in Germany, in the mines of the Hartz mountains. The track consisted of two parallel beams or sleepers of timber, between which the wheels ran on planks. The roads affording great facility, Queen Elizabeth employed German miners to construct similar ones in England in iron and coal mines. It often occurred that the carriages were thrown off the track by stones and other impediments, in order to obviate which iron tires with exterior flanges were put on the wheels. The rapid wear of the wooden rails, which did not last over six years, caused in 1738 the employment of flat bars of cast iron, which were secured with spikes to the wooden rails. In 1770 the continuous wooden support was replaced by stones and the flat rails by prismatic ones (*edge rails*), and next came the Vignole or T-rails. In 1776 Carr proposed to support the rails on wooden cross-sills, and in 1797 Barnes employed blocks of stone in place of the latter. Since 1810 wrought iron has been used for rails instead of cast iron, and the rails may thus be made 15–18 feet long, and much lighter than before when they were but 3–4 feet long.

At first railroads were only introduced to facilitate the transportation of burdens by horse-power, one horse drawing as much on the railroad as eight on a common road. After the invention of the steam-engine, Dr. Robinson suggested in 1750 that it might be used as a motive power on railroads, but the idea was ridiculed as insane; it was however pursued by Watt in 1769, and by Evans in North America in 1786, but without any practical attempt. It was only in 1802, after the invention of the high pressure steam-engine, that the inventors Trevithic and Vivian undertook the construction of a locomotive steam-engine, and in 1804 they obtained a patent for one to

move carriages on a railroad. The first engine drew on the Merthyr-Tidwyl road five carriages of iron-ore weighing eleven tons, a distance of nine miles in $1\frac{3}{4}$ hour. At the same time Oliver Evans constructed a locomotive in the United States, but it was not until 1824 that Stephenson built the first successful locomotive for the Stockton and Darlington railroad, by which at length passengers were transported in 1826. It still remained doubtful whether preference was not due to the employment of stationary steam-engines, until in 1829 Stephenson's locomotive "Rocket" was victorious in all trials. When in 1830 the Liverpool and Manchester railroad succeeded beyond expectation, and Stephenson's tubular boilers proved to be as safe as advantageous, the railroads at once rose to that high degree of importance which has ever since continued to increase. From that time no branch of industry has been so much the object of new inventions as railroads; the most ingenious men surpassed themselves in constantly adding new improvements to their engines. Self-acting inclined planes and stationary steam-engines were employed for overcoming steep grades, and new forces were sought in order to replace steam by a less expensive motive power, of which however atmospheric pressure was the only one practically attempted, in 1839, but has since been abandoned.

After England the United States were the first to introduce railroads with locomotive steam-engines. The first railroad in France was that from St. Etienne to Lyons, built in 1827; in Germany that from Nürnberg to Fürth, in 1835. Since then railroads have been constructed in all the European States, and in a few years a connected system of railways will be spread over all Europe.

After this brief historical review we will now proceed to treat of the construction of railroads and the motive power employed on them.

1. Location of a Railroad. The location or first determination of a railroad line is a matter of the greatest importance, as the success and value of the work are in a great measure dependent on a judicious selection of the line, and the highest qualities of talent and knowledge are required in the engineer who undertakes the task. The considerations that must mainly guide in the location are, the object of the road, the grades and curvatures, the physical conditions of the country, and the relative cost of the road in different locations.

The objects of railroads may be various. A main line which is intended to connect distant parts of a country and to serve as a basis for a system of branch roads which are to intersect the country in every direction, will be made to pass through the most important places only, pursuing its general direction without reference to minor towns. If a road in a sparsely populated country is intended to serve as a means of promoting its colonization, the physical conditions of the country will be the prevailing consideration, and the road will pass through those regions the agricultural or mineral products of which promise the greatest success. Again the object of a road may be to transport passengers and freight by the same power as rapidly as possible from one terminus of the road to the other; in this case the straight direction of the road would be a main condition, which, however,

would have to yield if unfavorable grades occurred, or the direct line could only be obtained by a disproportionate expenditure.

An important point to be kept in view in the location of a road is the distribution of excavations and embankments, which should, if possible, be so arranged that the amount of earth to be moved in either case is nearly equal. Opportunities of using the earth from neighboring hills for embankments must also be regarded; the surplus of excavated earth must either be disposed of by augmenting the side slopes of the embankments or else a suitable place of deposit must be provided near the road. Of still greater importance are the grades of the road, and great changes of direction or even the abandonment of a particular route may be occasioned by the unfavorable nature of the country. It is generally received that from 8 to 9 lbs. per ton is the resistance of friction on a level road, so that 1 in 280 is about the inclination at which the action of gravity equals the resistance of friction.

Descending grades should be carefully avoided when the point to be reached is higher than the point of departure. When favorable gradients cannot be obtained, we must at least endeavor to cross valleys on their highest ridges and hills on their lowest depressions, or else, if a satisfactory line cannot thus be obtained, the obstacles must be overcome by stationary steam-engines or by tunnels. The admissible grades on a railroad will be determined by the probable amount of transportation and the power which may be available in each case. The gradients may either conform in general to the face of the country and undulate with the same, or else the elevation to be overcome may be concentrated in some few places, where in consequence the grades will be short and steep, requiring the employment of additional locomotives or of stationary engines, while for the remainder of the road much more favorable grades and partial levels will be obtained. A road laid out on the first system requires in general less capital, and less labor on the part of the engineer, while the second system calls for the exertion of the highest powers on the part of the latter, and frequently involves a much larger capital; but on the other hand the speed will be much more uniform and the wear and tear of locomotives will be less than on the undulating grades, the varying power on which is very injurious to the engines. To which of these systems the preference is due in any particular case must be determined by existing circumstances, the value of a railroad depending mainly on the amount of transportation of freight and passengers. Whether the road is mainly to be used for travel or for transportation of freight will materially influence the choice of location, as in the former case speed, in the latter power, are the chief considerations. In cases where the bulk of transportation is in one direction, as on roads carrying coal from the mines to market, ascending grades in that direction will, if possible, be avoided altogether.

Another essential point to be kept in view in the location of a railroad line are the curves arising from changes of direction. Independently of the increase in length of the road the curves exert a very injurious influence on the locomotives and cars. In turning a curve the flanges of the wheels will

impinge against the rails, and the outside wheels must pass over a longer space than the inside wheels, and therefore are dragged a certain distance over the rail, which causes great friction and torsion in the axles. It has been attempted to diminish the dragging of the exterior wheels and the friction of the flanges by giving a conical form to the tire of the wheels and elevating the exterior rail in curves by a certain amount, by means of which the force of gravity will counteract the tangential velocity to some extent. Nevertheless the resistance of friction remains very prejudicial in practice, and its amount depends on the length of the radius of curvature, on the width of the track, on the length and weight of the train and its speed. It will become still more sensible if faults exist in the laying of the rails and in the construction of the cars.

2. Construction of a Railroad. In proceeding to the actual work of construction after having perfected the plans, the attention of the engineer must be directed to a great variety of points, all of which are essential to the ultimate success of the road. We will now follow the several steps of the construction of a railroad.

a. Grading. In railroads the principle that they should be dry and secure from inundation is of still greater importance than in common roads, as it is essential to the duration of the superstructure.

In order to give solidity to embankments the newly filled earth must always be spread equally over the road. Embankments of no great depth may be made solid by ramming and rolling, but if they are considerable, the filling should be done in layers and the material so spread as to produce a firm combination of the masses of earth. If the earth is to be moved but a short distance, wheelbarrows may be employed, but for distances of any considerable length two-wheeled carts are used, which are often made to run on temporary railroad tracks. Embankments should not be formed by filling from one side to the other, raising the whole at once (*side-forming*), but rather by embanking out from one end in the whole width of the bank, by which some solidity is given to the lower portion by the pressure of the superincumbent earth as well as that of the carts and workmen. When side-forming is resorted to it should be done as indicated in *pl.* 2, *fig.* 1 (that is to say, the filling should be commenced from the bottom for some distance along the embankment, by means of a guide-way, *b*, supported on trestles, *cc*, filling first the part *ad* of the slope, next *de*, and so on. The core of the profile is considerably solidified in this manner, but the method is expensive and slow). For very wide embankments (*fig.* 2), the two outside portions *bc* and *fg* may be completed first with the aid of temporary tracks, and the interior part *de* filled afterwards. All embankments are at first to be made higher than the required grade of the road by the probable amount of settling of the earth. Very high banks should be allowed at least a winter season to settle before the superstructure is laid, a precaution to be recommended for all embankments. The inclinations of the side slopes should always be less than that which the earth naturally assumes; it will generally be from 1 upon 1 to 1 upon 1½, and according to circumstances even 1 upon 2 and less.

The width of the roadway will depend on the number of tracks, but it is advisable always to grade for two tracks, even where only one is to be laid at first; because a subsequent widening of the embankments is always attended with a want of firmness, which is not counterbalanced by the advantage of transporting the material on the finished track. The distance between two tracks is made a little greater than the width or *gauge* of the track. From 4 to 5 feet are generally allowed from the end of the supports of the track to the beginning of the side slopes. In cuttings, at least 4 feet should be left between the longitudinal supports of the rails and the side-drains. To preserve the side slopes they should be sown in grass seed or sodded; low bushes may also be planted to advantage.

In order to keep the road dry, drains are made along the foot of embankments. In excavations, drains are necessary not only by the sides of the roadway, but also above the side slopes, in order to carry off the surface water. *Pl.* 2, *fig.* 3, gives an idea of such an arrangement when walled drains, *b d f e*, run along the road *i h i; k* is the ordinary ditch, *l* a second one on the hill side. In England gutters of earthenware or other drains, *g*, are sometimes used under the middle of the track to carry off the water from the superstructure.

Cross-drains or culverts are constructed in various ways, of which some examples are given in *figs.* 4, 5, 6, and 7. In wet or marshy soil drains must be made under the body of the road emptying into the side drains; an example of this is given in *fig.* 3.

In localities where land is very expensive, and stone can be obtained at moderate cost, the extent of the side slopes both in cutting and filling may be diminished by building *sustaining walls*, of which *figs.* 11 and 12 show examples. They may be built of dry masonry, and should have a batter of at least 1 upon 10.

The best materials for embankments are gravel, sand, and clay; clay, which mixes very readily with water, and earth containing vegetable substances, are least adapted to the purpose. In marshy localities it is often requisite to remove the upper stratum to the depth of several feet, and to fill in solid material, such as gravel. When this is not sufficient, and the subsoil will not sustain the weight of the road and trains, it is best to drive wooden piles on which the superstructure for the railroad is placed. *Fig.* 24 shows a road partially sustained by piles.

In regions where timber is abundant, the use of wooden trestles or truss-work in the place of embankments is sometimes resorted to. Structures of this kind are required to be very firm in order to withstand the racking caused by the passage of the trains. Embankments are generally filled in afterwards to take the place of the woodwork as it decays, and this system is found very suitable in cases where the funds for the construction of a road are not abundant, and it has to be built in part from its income. *Pl.* 2, *figs.* 13, 14, and 15, represent a structure of this kind; *fig.* 13 is a side view, *fig.* 14 a top view without the superstructure, and *fig.* 15 a cross-section. The sleepers *a a* support the three uprights *b b b*, sustained by the side-braces *d d*, which form a kind of truss with the cross-tie *c c;* on the

latter rest the timbers *e e* which support the track; *f f* are the stringers on which rest the longitudinal sleepers of the track or the rails; *g g* are side railings.

As railroads frequently cross common roads, regard must be had to these crossings in arranging the grades of the road. If the highway is to pass above the railroad, which consequently is in excavation, the depth of the cut, as well as in all cases the importance of the road, will determine the manner of bridging. The clear space between the bridge and the rails should in general not be less than 16 feet, in order to allow a free passage for the chimneys of the locomotives. When the cut is of a less depth, the required elevation must be attained by making an embankment on the highway on each side of the bridge, the grade of which must not be steeper than 1 in 15. A separate chapter will be devoted to the construction of bridges; but to illustrate road-crossings, we have given in *pl.* 2, *figs.* 16, 17, and 18, a viaduct of masonry; *fig.* 16 is a side view on the left, and a longitudinal section on the right; *fig.* 17 is a ground plan of an abutment, and *fig.* 18 a horizontal section below the roadway. *Fig.* 19 shows a perspective view of a viaduct of very similar construction.

When, on the other hand, the grade of a railroad is at a considerable elevation above a highway, the former must cross on a bridge, which, whether built of wood or stone, must have strong abutments and wing walls of stone to sustain the embankments on both sides. *Fig.* 20 shows a viaduct of this class; *fig.* 21 is the ground plan of an abutment, and *fig.* 22 a horizontal section below the roadway. In cases where the railroad crosses a valley on a viaduct, no especial construction will be required for a road-crossing, except perhaps a slight change in the direction of the highway, in order to make it pass through one of the bays of the viaduct. When the elevation of the railroad is not sufficient to allow the highway to pass under it, the latter is brought to the level of the former by means of embankments. Road-crossings on a level are prohibited by law in England. They are, however, very frequent in the United States and in Germany, and no accidents appear to have occurred at such crossings where proper care has been used. An elevated pavement of wood or stone must be laid at such crossings, even with the top of the rails, as shown in *figs.* 45, 46, and 47. The edges of the pavement next to the rails are covered with flat iron bars, *b b'*; they must not approach the rails on the inner side nearer than about two inches, in order to leave the spaces, *c* (*fig.* 47), for the flanges of the wheels. They are either even with the rails (*fig.* 46) or elevated above them as in *fig.* 47; the latter arrangement has the advantage that the wheels of the carriages crossing the railroad will not touch the rails, while on the other hand it has the disadvantage that dirt accumulates easily on the rails, causing great friction, and sometimes even throwing the cars off the track; constant attention, therefore, is required in such places.

Rivers and streams are crossed by railroads on bridges built either of stone, wood, or iron, and requiring various modifications of construction according to the length and angle of the crossings. The chapter on *bridge-*

building will give the details on this subject. Drains and small water-courses are crossed by means of *culverts*, which are also bridges on a small scale. An arched culvert is represented in *pl.* 2, *figs.* 8, 9, and 10, in front view and cross-sections. When the elevation of the track is not sufficient to admit of an arched stone culvert, iron plates may be employed; and when locomotives only are used, it is not necessary to cover the drain, longitudinal string-pieces being laid across the opening to support the rails.

When the line of a railroad is interrupted by rocks or hills where an excavation is impracticable, and the location of the road cannot be changed, it becomes necessary to pierce the obstacle by *tunnels*, which are driven according to the principles of mining, and which if very long require to be ventilated by shafts from above. *Fig.* 23 shows the mouth of a railroad tunnel in a mountainous region.

b. The Superstructure. The durability and safety of a railroad are altogether dependent on the quality of the rails, and on their being firmly fastened to solid supports imbedded below the roadway surface. These supports may either be of wood or stone, and may continue without interruption along the track, or support the rails only at certain intervals. The first railroads had continuous supports and flat bar rails, called *plate* or *tram rails;* but the difficulty of procuring the large quantities of timber required for that kind of superstructure, and its great cost, together with the extensive manufacture of iron in England, soon led to the adoption of rails of sufficient strength not to require a continuous support, but capable of bearing the load when sustained only at intervals by stone or wooden sills to which they were attached by iron *chairs.*

The stone used for supports should be of the densest and hardest kind; a block intended for the support of one chair should measure at least 2 feet each way, but generally the top face only need be dressed. Those blocks on which the ends of two rails meet should be still longer, as on them the load is not sustained by the rigidity of the rails. To fasten the chairs to the stone supports, holes are drilled by machinery into the blocks 6 inches deep and 1 or 1½ inches in diameter, to correspond exactly with the holes in the chairs. The blocks are generally not simply sunk into the roadway, but a bed of dry masonry 1 to 3 feet thick is carefully laid under each track, of the width of the supports. On this bed the blocks are accurately adjusted to the level of the road and firmly packed with gravel, after which the road is filled up with earth, gravel, or broken stone, to the level of the blocks, and well rammed. The top layer is made with a transverse convexity for the better drainage. *Pl.* 2, *fig.* 30, shows a ground plan of this arrangement, *fig.* 31 a section. The distance from centre to centre of the supports varies from 3 to 5 feet; it appears, however, unadvisable to exceed the measure of 3 feet 4 inches, by which a rail of 15 feet length has five supports. A distance of 3 feet is still preferable, but more expensive. In order to prevent the lateral displacement of the rails more effectually than could be done by a large number of supports for single chairs, large stone sills have been employed extending entirely across the track and receiving two chairs, as may be seen in *figs.* 30 and 31.

As all embankments settle more or less according to their depth, it becomes necessary to re-adjust the level of the stone blocks by packing gravel underneath, which, on account of their weight, is very expensive. In order to avoid this, wooden cross-sills are generally first used on embankments for the time of their duration, after which they are replaced by stone blocks, as the road will have become settled by that time. *Fig.* 29 shows one of these wooden sills. They have great advantages when placed sufficiently near each other. The best kinds of wood are used for the purpose, generally oak, which sometimes is *kyanized.* They should be twelve inches wide, from 4 to 6 in thickness, and 6 feet long, and are generally flattened on top, or else only notched to receive the rails. They are laid on beds of broken stone, and should not be more than 3 feet apart from centre to centre. Opinions differ as to the proper height of the filling between and outside of the tracks. Some keep it below the top of the sills in order to keep the rails clear of earth, and to air the wood, which they suppose assists its preservation; while others prefer to fill up as high as can be done without interfering with the flanges of the wheels; because wood, especially oak, is in fact better preserved by being entirely covered with earth than when partially exposed to the air; and because such filling protects the wood from being set on fire by coals dropping from the locomotives: and besides, in case of the locomotive or any carriage running off the track, the revolution of the wheels will be gradually stopped, diminishing very much the breakage and danger attendant upon such accidents.

The fastening of the chairs on stone supports is shown in *pl.* 2, *fig.* 33, which illustrates the method used on the London and Birmingham road. First holes are drilled of 1½ inches diameter, to correspond with those in the chair; on the bottom of the holes iron or wooden wedges, *e*, are placed with the edges upwards, and oaken pins, split at the lower end and tarred, are driven into the holes and cut off even with the chair. The iron spikes *d*, chisel-shaped at the lower end, and sometimes barbed, are then driven home, and confine the chair firmly to the support. The rail *a* is then placed into the chair and fastened to it by the wedge *c*. We must not omit to mention that the stone-blocks are frequently split by the successive driving of the pins and spikes, and afterwards by the swelling of the pins by moisture. Between the chair and stone-block must be placed a plate of wood, or else a piece of felt, ¼ inch thick, and soaked in oil, in order to break the rebounding which would otherwise be intolerable and ruinous to the cars.

The first rails were of cast-iron, and it was not until 1820 that at Birkingshaw, under the direction of J. Stephenson, wrought-iron rails were produced. Those of cast-iron had the double disadvantage of being necessarily very short, and so brittle as to break readily when not continuously supported. They can be used only on roads where the superstructure is made as is shown in *figs.* 25 and 26, where the rails, *d*, are supported by longitudinal sills, *b*, which rest on the cross-sills, *a*; or as in *figs.* 27 and 28, where the rail-stringers, *c c*, rest on stone-beds, *a*, which have supporting walls at the junctions of two rails. The use of cast-iron rails has been almost

entirely abandoned since the advantages of wrought-iron rails have been fully recognised.

The requisites of a good rolled rail are the following: 1. It must be rolled at an equal temperature throughout, and be entirely free from flaws. 2. The profile must be precisely the same at both ends, in order to allow perfect fittings to be made. 3. The rail must be perfectly straight, and must have a suitable form. 4. It must offer sufficient surface to the driving wheels without at the same time producing too much friction; the surface is therefore generally slightly convex, in order to fit the conical tire in some measure. 5. That cheek of the rail which is exposed to the greatest pressure must be sufficiently strong not to break, and somewhat rounded, in order to correspond to the flange of the wheel.

For the system of interrupted supports (*pl.* 2, *fig.* 32), the form and weight of the rails depend on the weight of the locomotives to be employed, their required speed, and the distance between the supports, as no flexure should take place. Various forms of rails have been used; those most generally employed now have a broad base, an oval top, and are from 3 to 5 inches high. A weight of 16 or 17 pounds per foot is generally deemed sufficient; rails of much less weight have been employed on roads over which no very heavy trains are transported. The usual length of rails is 15 or 18 feet, and the ends meet at right angles, although an angle of 45° would be preferable, as diminishing the shock in passing from one rail to the next.

The fastening of the rail and chair has been effected in many different ways; at present it is simply done by fastening the rails to the sills by means of spikes, the heads of which lap over the base of the rail, and at the ends only iron plates with projections that hold down the rail are used. Some of the more complicated chairs are shown in *pl.* 2; *fig.* 33 is a cast-iron chair of the London and Birmingham road, the manner of fastening which has been referred to above; *fig.* 34 shows Hartley's chair for the Manchester and Bolton Road, which is fastened with spikes, *c*, the dotted lines showing the fastening between the chairs; the rails here weigh 20 pounds per linear foot. *Fig.* 36 represents the chair and rail on the Northern road in Austria, where the rail *a* is held in the chair *b* by the heads of screw-bolts *c*. *Fig.* 37 is a cast-iron bridge-rail and chair of the Providence (R. I.) road. The shape of the spikes is shown in *fig.* 35. *Fig.* 42 shows Stevenson's attachment of chair and rail by which he intended to obviate the existing imperfections, but which was found too complicated and requiring too much accuracy in the execution for practical use, although well calculated to answer its purpose; *a* is the rail, *b* the chair, *c* the wedges, *d* the spikes, &c.

The method of fastening the rails in the chairs by means of wedges of wrought-iron has proved to be imperfect, the wedges being loosened by the vibration of the track caused by the passage of the trains. The wedges in *fig.* 33 are of oak-wood prepared with a solution of corrosive sublimate (*kyanized*) and compressed by hydraulic pressure; these also are found to become loosened, and require constant driving, besides having other disadvantages. Wedges of tempered cast-iron have been employed with the best success.

The foundation for a superstructure on the plan of *continuous support* for

the rail is generally a uniform layer of broken stone, into which the sleepers are imbedded and firmly settled with beetles until no sensible sinking takes place. The cross-sills are rough hewn in order to remove the sap-wood, and their ends generally project 12–18 inches beyond the sleepers. The longitudinal sills are let into the cross-sills, and are either wedged or fastened by means of chairs. In the South it is best to use yellow pine for these, as that wood warps and cracks less from the effects of the heat than oak.

The arrangement of the timber is shown in *pl.* 2, *figs.* 25 and 26, with a rail as in *fig.* 39. The longitudinal sills or stringers will have a depth of from six to ten inches, according to the strength of the rail and the proposed burdens; the supports may be four feet apart, and the length of each stringer should not be less than twenty feet in order to avoid too frequent breaks, which in one track should always be opposite the middle of a stringer on the opposite track. In the same way the joints of the rails should never correspond with those of the stringers.

Superstructures of this kind being very expensive in countries where timber is scarce, they have not been introduced to a great extent in Europe; even in the United States the lower sleepers have frequently been dispensed with on that account, the cross-sills resting in beds of broken stone. In the place of wooden supports a stone superstructure has also been employed, consisting of two continuous parallel walls of stone, connected by cross-ties of stone, which may be replaced by wooden sills of one foot square, or else by iron rods and binders, where stones of sufficient length cannot be obtained. The direct attachment of the rails to stone being very injurious, as stated above, wood must be interposed between the rail and the support. Plank of two inches in thickness will suffice for rails of two inches depth, but heavier string-pieces will be required for rails of less size. Grooves of the width of the wooden stringers are cut into the stone of such a depth that the top of the rail is at least two inches above the rough-dressed stone surface, in order to allow room for the flanges of the wheels. The fastening of the rail may be done as in *pl.* 2, *fig.* 33; *figs.* 27 and 28 show a superstructure of this kind.

The rails used with continuous supports are of very different forms and sizes, varying from three pounds to eight and even thirteen pounds per linear foot. The ends are generally cut off at an angle of 45°, sometimes also in the form of a *mitre joint* (*fig.* 40), which is preferable. The rails are fastened to the supports by spikes or screws, the holes for which are one eighth of an inch longer than required, in order to allow for the effect of temperature upon the iron. Under the joints are placed plates of zinc or iron, to prevent the ends of the rails from being pressed into the wood. An excellent form for the flat rail is that shown in *fig.* 39, weighing nine pounds per linear foot, which was devised for the New Orleans and Nashville railroad. *Fig.* 41 shows the ordinary flat rail. Of many other different forms we only instance that proposed by Strickland, the *bridge* or U-*rail* (*fig.* 38), weighing 13½ pounds per linear foot, and a similar one by J. K. Brune (*figs.* 43 and 44), which has a more convex bearing surface than the preceding.

Pl. 3, *fig.* 28, is a plan of the superstructure of the Baltimore and Ohio Railroad; *fig.* 23 is a longitudinal section; *fig.* 27, a cross-section of the same. *Fig.* 26 shows the attachment of the rail to the sill by plates and screw-bolts; *fig.* 24 is a top view and *fig.* 25 a side view of the chair. The whole forms an excellent arrangement.

In laying the rails the effect of changes of temperature upon their length must be paid attention to. The difference in length at extremes of temperature is from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in a rail of 18 ft., and if the rails were laid close to each other at a low temperature the track would inevitably be torn up by an increase of heat. In order to avoid this, pieces of iron gauged to thicknesses corresponding to the existing temperature are interposed between the ends of the rails while they are being fastened to the supports.

The distance between the inner edges of two opposite rails is called the *gauge* of the track. On the first railroads in the coal-mines the gauge was from 3 ft. to 3 ft. 6 inches, but on the introduction of locomotives the gauge was increased, and Stephenson first introduced the gauge of 4 ft. 8½ inches on the Stockton and Darlington road. The success of his locomotives caused them to be employed everywhere, and thus the above gauge of 4 ft. 8½ inches came to be almost universally adopted. A wider gauge was subsequently considered by Stephenson himself preferable for the more powerful engines built since then; and Brunel proposed a gauge of 7 ft. for the Great Western Railway, which was adopted. In Russia and in Baden a gauge of 6 ft. was introduced, but in the latter state it was found necessary to lay extra tracks for the narrow gauge in order to accommodate trains from adjoining roads. The broad gauge is also used on the Atlantic and St. Lawrence Railroad in Maine.

The distance between the rails must be greater by about $\frac{3}{4}$ of an inch than that between the flanges of the wheels, so as to allow a play of $\frac{3}{8}$ of an inch for each wheel, without which the friction would be too great. A larger play would prove destructive to the road and to the carriages by allowing the latter to rock violently from side to side. The flanges (*pl.* 5, *fig.* 14 *c* and *fig.* 12 *a*) are on the inside of the wheels and guard the carriages against sliding off the rails.

On railroads consisting of a single track provision is made for allowing two trains to pass each other by an arrangement called a *siding* or *turnout*, consisting of a portion of a track laid by the side of the main track, at a suitable distance from it, and connected with it at each extremity by a curved portion, which is so arranged by means of a movable part that the cars can either continue on the main track or enter the turnout, as circumstances may require. The curved portion must be composed of two arcs of circles, one tangent to the main track, the other tangent to the siding, and both tangent to each other midway, but convex in opposite directions. The movable portion by means of which the cars may be made at pleasure to take either track is called a *switch*. A simple arrangement for turning out to the right is shown in *pl.* 2, *fig.* 48, where *a a* are the rails of the main track, *b b* those of the turnout; the latter do not come close up to the former, but leave a space of 1½ or 2 inches in order to allow the

flanges to pass when the train continues on the main track. Two rails of the main track are connected by the iron bars *c c*, and are attached as usual to chairs at the ends furthest distant from the turnout; each rests on a cast-iron plate provided with shoulders, *e e*, and is movable by means of a lever attached to the end of the bar *d*, its elasticity allowing it to be bent so as to be on a line with *b*, the shoulder *e* limiting the extent of the motion. When it is desired to turn out on either side of the main track, the switch is arranged as in *fig.* 51, where the rails *e h* turn out to the left and *g k* to the right.

Another kind of switch is shown in *fig.* 50; the movable rails and the tongue *s* turn on pivots, and are placed in the desired position by means of a lever attached to *m*. The construction of such a lever is seen in *pl.* 3, *fig.* 29; it is contained in a box, *ghkl*, which is partly imbedded in the earth. The lever *d* turns on the pivot *c* and moves the switch by means of the bar *b*, attached at *a;* it is also connected by the band *e* with a spring, which is compressed when the lever is brought from the position *p* into the position *q*, when the switch is aligned with the side-track. When the pressure on the lever is relinquished, the action of the spring will replace the switch in its position in the main track. The switch just described is used on the London and Greenwich Railroad. When the guide-rails do not move on pivots, but are only bent, they will of their own accord return to their former position as soon as the pressure on the bar is relinquished. Another switch for a turnout is shown in *pl.* 2, *fig.* 49, which is an excellent plan.

An arrangement similar to a siding, termed a *crossing*, is made on roads with double tracks to enable trains to pass from one track to the other. *Fig.* 52 represents a crossing connecting the two tracks CE and DF in every direction; *ab*, *cd*, *ef*, *gh*, are the rails of the tracks; *ik*, *lm*, *no*, *pq*, *rs*, *tu*, *vw*, *xy*, those of the crossing. $\alpha\beta$ and $\gamma\delta$ are two rails 6 ft. in length, forming part of the main tracks and held together by ties as the figure shows; they can be moved about a pivot in the centre so as to form the connexion between any set of corresponding rails, as may be desired. Cast-iron plates, called *crossing-plates* or *frogs* (*fig.* 54), are laid where the rails cross each other: *d*, *e*, *f*, *g*, are the ends of the rails; the piece *abc* of wrought-iron is riveted or screwed on the plate, and the cheeks *m* and *n* prevent the wheels from sliding off. It may be preferable to weld the rails together in the requisite form, as in *fig.* 53, and to lay the pieces *p* and *q* at the sides to keep the flanges in the proper direction. For unimportant crossings short tongues of wrought-iron, fastened on wood and brought into the required position with the foot, are generally sufficient.

Pl. 3, *fig.* 9, represents a switch with a counterpoise, *u*, which causes the switch to assume its position in the main-track whenever left to itself. The switch in use on the Magdeburg and Leipsic road is represented in *figs.* 10, 11, and 12. It is moved by a crank, *h*, *h* (*fig.* 12), or an eccentric in the box, *e*, and the position of the target, *n* (*fig.* 11), to the right or left always indicates the position of the switch, the two sides of the target being, moreover, painted of different colors.

When two tracks diverge at a considerable angle where there is no room for curves, as at the stations, horizontal disks of wood or iron, called *turn-tables*, which revolve about a centre, are employed to transfer cars from one track to the other. The turn-table is crossed by rails on which, when in line with one of the tracks, the carriage is drawn; the table is then revolved until the rails are in line with the other track, when the carriage can be moved on. Turn-tables are also used to reverse the position of the locomotive on the track.

The upper part of *pl.* 3, *fig.* 4, shows the top view, the lower part the substructure; *fig.* 5 a section of a turn-table of wrought and cast iron, which is in very general use. It revolves about the centre pin, A, on eight cast-iron rollers, B, B, ten inches in diameter, carried by the rods, *c*, *c*, which centre in a wrought-iron ring, D, that turns about the centre pin. The bearings of the rollers and of the centre pin are plainly seen in *fig.* 5. The whole is inclosed by a cast-iron ring, E, cast in four pieces. The disk consists of four arms, I, I, crossing it at right angles, and four others, K, K, which radiate from the centre; the spaces between the arms are filled with an iron grating. On the top of the table are two tracks crossing each other at right angles, and corresponding exactly with the track of the road in gauge and level. Turn-tables of this construction have generally not more than 16 feet diameter. A turn-table calculated to receive a locomotive and tender of 30 feet in length is represented in *pl.* 3, *fig.* 1, as seen from below; *fig.* 2 is a cross-section on the line A′, B′; *fig.* 3 a longitudinal section on A, B. It revolves in a circular well, and consists only of a zone just wide enough to receive the track, in order to be as light as possible; it is readily moved by two men when loaded with the engine and tender.

c. Stations. The arrangement and size of the buildings at railroad stations depend of course on the amount of travel and transportation at each station. Stations of importance have, besides the hall for the arrival and departure of the cars, a ticket-office, a sitting-room for passengers, a restaurant, baggage-room, &c.; warehouses for goods, locomotive and car houses also belong to main stations, together with offices for the transaction of the business of the road. On *pl.* 3, *fig.* 30, is a view of the Leipsic station of the Saxon and Bavarian railroad.

At suitable distances along a line of railroad are water-stations for the supply of the tender. The water is contained in an elevated reservoir from which it is carried to the tender by a pipe. *Fig.* 6 shows a water-pipe of improved construction; the pipe *b* issues from the reservoir, and is closed by the stop-cock D; when this is opened the water rises in the column A to the valve H, which is closed by the weight *b*, and opened by means of the lever *d*, when the tender is brought under the supply-pipe F, which can be turned in all directions on the support B, E, having a water-tight joint at G. *Fig.* 6 *a* is a section on the line 3, 4; *fig.* 7 one on 1, 2, and *fig.* 8 one on 5, 6. Arrangements for warming the water in the reservoir in winter are necessary in cold climates.

3. Motive Power on Railways. The power by which loads are trans-

ported on railways is that of horses, steam, atmospheric pressure, or gravity. The employment of horses on railroads differs from that on ordinary roads only in their being able to draw much heavier loads. We therefore proceed at once to the consideration of the locomotive steam-engines and cars. The employment of atmospheric pressure or gravity requiring special modes of construction, we shall treat of them under separate heads.

a. Locomotives. The general features of a locomotive, aside from the tender which carries the supply of fuel and water, are the following: A tubular boiler is supported on a frame with four, six, or eight wheels wedged firmly on their axles, which turn in bearings. Below the boiler or on both sides of the frame are two cylinders, the piston-rods of which cause the axles of the driving-wheels to revolve either by means of cranks or by wrists on the outside of the wheels. The other wheels either revolve independently, in which case they are smaller than the drivers, or they are coupled with the latter by connecting rods, when they must be of exactly the same diameter.

Pl. 4, *fig.* 1, is a side view of a locomotive, *fig.* 2 a vertical section through one of the cylinders, *fig.* 3 a horizontal section in the plane of the sliding-valves, and *figs.* 4, 5, and 6, represent the apparatus for working the valves and reversing the motion in different positions of the eccentrics. A is the boiler, C the fire-box, F the smoke-box, and G the chimney. The boiler is cylindrical, and is made of sheet-iron of about $\frac{5}{16}$ of an inch in thickness, riveted steam-tight with $\frac{3}{8}$ inch rivets. It is covered by a casing of strips of inch plank, hooped together to diminish the radiation of heat.

The fire-box has double sides, the inner being of sheet copper; it descends about two feet below the bottom of the boiler. The grating is in the middle of the bottom part. It is seen by *fig.* 2 that the fire-box is surrounded by water in all parts but the door and the grating. The tubes or flues extend from the fire-box to the smoke-box, and are entirely surrounded by water; there are from sixty to one hundred and eighty flues in a boiler, and it is the large amount of heating surface gained by this arrangement that constitutes the superiority of the tubular boilers over all others in the production of steam. If any of the flues collapse, the water will enter the fire-box and put out the fire, but no explosion will ensue.

Below the smoke-box are the two steam-cylinders VV. Above the fire-box is the steam-dome D, into which the steam rises before passing on to the cylinders, in order to deposit the particles of water which it carries with it. The steam then descends as the arrow shows through a funnel, and passing along the pipe S arrives at the cylinders, as shown by the second arrow. The enlarged portion of the steam-pipe is screwed into a corresponding opening at the back of the fire-box, which is covered by a plate provided with a packing-box, through which passes the spindle of the regulator or steam valve. By this valve the quantity of steam admitted into the cylinders is regulated, and it is constructed in various ways. In the engine before us it is what is called a disk valve, consisting of a circular plate, from which two segments are cut, working steam tight against a similar

plate at the entrance of the main steam-pipe S; when the movable plate is turned by the crank so that its openings correspond with those in the stationary one, the way is opened for the steam from D to S; if the movable plate be turned a quadrant, then the openings are closed and the steam is shut off from S.

The main steam-pipe S passes through the forward end plate of the boiler, and is connected with two descending pipes which carry the steam to the steam-boxes U U, whence it is delivered by the slide-valves to the cylinders; the cast-iron steam-boxes are situated immediately over the cylinders, and are screwed fast at their ends to the boiler plates. The slide-valves also communicate with the exhaust-pipe F, which conducts the steam after it has operated upon the pistons into the chimney G, as indicated by the arrows (*pl.* 4, *fig.* 2). This almost interrupted stream of steam into the chimney creates a powerful draught, which in stationary engines is accomplished by the height of the chimney. Rods connected with the slide-valves, and passing through stuffing-boxes in the steam chambers, which are actuated in a manner hereafter explained, serve to bring the valves in a proper position to throw the steam alternately upon one side or other of the pistons. When the slide-valve is in the position seen in *pl.* 4, *fig.* 30, the steam is thrown upon the back of the piston, while the space in front of the piston is opened to the exhaust-pipe. When a contrary motion takes place in the slide-valves, then the space at the back of the piston is thrown open to the exhaust-pipe, and the steam rushes out from this side of the piston. The piston passes through a stuffing-box in the head of the steam-cylinder, to prevent leakage of the steam and the consequent loss of power. The end of the piston-rod is attached to a cross-head which runs upon ways, and is connected by a joint with a connecting-rod, which embraces at its other end the crank upon the shaft of the main driving-wheel, which thus receives its motion from the piston.

We come now to the apparatus which serves to regulate the motion of the slide-valves; in general this is accomplished by eccentrics, of which at least two are necessary in the locomotive, as there are two cylinders to be operated. These eccentrics are seen at E, in *figs.* 3, 4, and 5, and give motion to the connecting-rods *e f*, which operate the double-armed levers *l i*, connected with the rods, *m*, which move the slide-valves. The eccentrics are so arranged that they admit the steam to the cylinder just before the piston reaches the end of its stroke; the steam thus operates as a cushion to receive the blow of the piston, and prevent the injury which would otherwise result to the machinery. This is called the *lead* of the engine. *Fig.* 6 shows an arrangement of double eccentrics, for the purpose of reversing the motion of the engine.

The wheels are an important part of the locomotive; they are constructed in a great variety of ways. In the machine before us two kinds of wheels are used. The middle or driving-wheels have no flange, and a diameter of 6 feet; the other two pair, the running-wheels, are 4 feet in diameter, and are furnished with flanges, which serve to retain the locomotive upon the rails. The rim of the wheels consists of two concentric hoops. The interior, to

which the spokes are secured, is of cast-iron; the exterior is of wrought-iron shrunk on while hot. The wheels are all secured fast to their axles, which project out beyond the wheels, and run in composition-boxes which have their seats upon the cheeks or pendent arms, seen in *fig.* 1, formed of strong plate iron, with which the wooden frame of the locomotive is covered. Upon the top of each of the journal-boxes rests the end of a vertical rod, the other end of which is connected with the spring, which for the driving-wheels is placed above the main frame of the engine, and for the running-wheels below; the springs are all secured to the main frame, and each bears its share of the weight of the locomotive.

The boiler is secured to the main frame by six iron knees. P is the man-hole, to enable the inside of the boiler to be cleansed. O is the safety-valve, and upon the steam-dome there is another, immediately under the control of the engineer, while the other is beyond his reach. The valve at the back of the engine is connected with a lever secured to a spring balance, which serves to show at any moment the pressure of the steam within the boiler. Upon the top of the boiler, near to the position of the engineer, is the steam-whistle, for the purpose of giving signals; this consists of two hollow metallic half globes or balls, the upper one of which has a sharp edge, and is placed immediately over the lower one. Within the lower half globe is another slightly smaller, so arranged that between the two there is a narrow opening or slit all round the edge. When the steam is admitted from the boiler between the two cups of the lower half globe, it rushes out of the opening between them against the sharp edge of the upper cup, and the well known whistle is produced.

Upon the end of the boiler, near the fire-door, is a glass indicator for showing the height of the water in the boiler.

To soften the concussions of the cars with each other, and with the engine while in motion, and also as a measure of safety in case of accidents, both the locomotive and the passenger cars are furnished with *buffers*, *a* (*pl.* 5, *fig.* 19). These are cushions stuffed with horse-hair or other elastic substance, either alone or in conjunction with steel springs. They are seen at the extreme forward end of the locomotive carriage in *pl.* 4, *fig.* 1.

The locomotive is always accompanied by its *tender*, which carries a supply of fuel and water; it is seen in *pl.* 5; *fig.* 9 is a side view, *fig.* 10 a longitudinal section, *fig.* 11 shows one half of the upper portion of the tender in plan. Upon the frame P, running upon four or six wheels B, rests a horse-shoe formed body, which serves to contain the water for the supply of the locomotive. This water receptacle is made of sheet-iron, and is entirely covered in upon top, where there are three holes closed by valves or covers; the centre one Q receives the water, and the others communicate with spaces separated from the water-chamber, and which are used to carry tools and other articles which may be required during the journey. The vacant space left by the peculiar form of the water-box serves to carry the fuel. The water is fed to the locomotive through the tubes P′ and A′, having flexible joints to enable them to accommodate themselves, without breaking, to the motion of the locomotive and tender. The tender is con-

nected with the locomotive by chains and hooks seen hanging from the buffer in *fig.* 9.

A cock in the supply-pipe K (*pl.* 4, *fig.* 3), within reach of the engineer, serves to regulate the supply of water to the engine; and there is also a cock upon the tender to shut off the water entirely. The supply-pipe terminates in a chamber K (*fig.* 2), from which the water is taken by a pump which forces it into the boiler.

Pl. 5, *fig.* 1, is a longitudinal section of Stephenson's locomotive with variable expansion; *fig.* 2, front view of the same, the end plate of the engine being removed; *fig.* 3 *a* is a horizontal section of the cylinders; *fig.* 4, a vertical section of the same; *fig.* 5 is a view of the pump; *fig.* 6, section of the end of the exhaust-pipe; *fig.* 7 *a*, section through one of the slide-valves; *fig.* 7 *b*, a plan of the same; *fig.* 3 *b*, view of the piston with metal packing, seen in section in *fig.* 3 *c*; and finally, *fig.* 8 illustrates the position of the different parts of the valve-gearing during the operation of the machine. As we have already explained the construction of a locomotive, it will be sufficient to enumerate those parts which differ essentially from the one already described. A is the main frame of the machine. The springs C rest upon the rods D, as already explained, the whole weight of the locomotive being carried by the rods E *l*; b^3 is the dome, which is furnished, instead of a cock, with a slide-valve *n′*, the rod L of which passes through a stuffing-box in the steam-dome, and thence to the position of the engineer, where it is managed by the levers *b b′*. Upon the pipe which carries the steam from the boiler is a safety-valve, beyond the reach of the engineer, kept down by a spiral spring, as seen in *fig.* 1. G is the lower end of the chimney, G′ is the man-hole, H are the steam cylinders. The cylinders F F have their valves upon the inside, close to each other; this is rendered necessary, as we shall presently see, by the expansion arrangement. The exhaust-valves of both cylinders open into a common chamber T (*fig.* 4), whence the steam passes by the two side pipes to the exhaust-pipe *k*, which by means of a double-angled lever may be more or less closed by the engineer as required. The steam may also be thrown into a chamber, U, whence it is blown out beneath the locomotive through a slide valve, Q (*figs.* 4–7 *a* and 7 *b*), also manageable by the engineer without leaving his station. The pistons *j j* (*fig.* 3 *a*) are furnished with spring metal packing, as seen in *figs.* 3 *b* and 3 *c*. The piston-rods O are connected with the cranks upon the driving-wheel shafts. The steam-pipe K carries the steam from the steam-dome to the valve-chest and cylinders, as in the former case, the valves receiving their motion from the shaft of the driving wheels, which have already been set in motion by the pistons. The *variable expansion* was effected by Stephenson by what is technically called *link motion.* For each valve there are two eccentrics by the side of each other, and so placed upon the main driving-shaft that one of them will drive the valve-rod forwards and the other backwards. The forward ends of these connecting-rods are united by a link, which has a slat in the middle, in which plays a pin connected with the end of the valve-rod. By this simple and effective arrangement the forward or backward motion is effected, with-

out the necessity of uncoupling the eccentrics; all that is necessary being to change the lever I′ from one extreme of the arc in which it moves to the other, which, through the levers *k′ h′*, so changes the position of the slotted link that it either lies at its top or bottom, and receives motion from either one or other of the eccentrics. If the lever I′ is in a vertical position, then neither of the eccentrics will predominate, the slide-valve will remain stationary, and no steam will be admitted to the cylinders. The working by expansion is effected in the following manner. In the vertical position of the lever I′, although the driving-shaft may continue to revolve, no steam is admitted to the cylinder; when, however, this lever is at either extreme of its motion, the valve-rod makes its full stroke, the valve opening its entire passage to the cylinder; consequently the nearer the lever I′ is to its vertical position, the shorter will be the stroke of the valve-rod, and the sooner the steam will be cut off and permitted to act by expansion. Thus the engineer has it within his power, by operating the lever I′, to work his engine with any degree of expansion, forwards or backwards. The feed pump is at P, *fig.* 1, and in detail *fig.* 5; *fig.* 2 shows the arrangement of the tubes in the boiler.

Of the numerous improvements which have been made in locomotives, we will mention only one, which has caused quite a revolution in their construction. William Norris, of Philadelphia, ran the connecting-rods to crank-pins in one of the arms of the driving-wheels, in place of attaching them to cranks upon the axles. The advantages of this modification are very great, and most of the European locomotives are now built upon this plan. In the Norris locomotive the cylinders, with their valve chests, lie outside of the main frame upon both sides of the boiler. By the whole arrangement a double advantage is gained. Where the crank was upon the driving-axle it described a circle equal to the half stroke of the piston, added to the thickness of the crank-wrist; consequently the stroke could not be lengthened without raising the boiler. This is not now necessary, and the diameter of the boiler may be increased, and consequently the number of the flues and the extent of heating surface, as well as the length of stroke of the pistons. The axles being now perfectly straight, are stronger and more durable with the same weight of iron. The working parts are more exposed to view, more easily controlled, and in case of injury or accident are more easily repaired.

b. Passenger Cars. Railroad cars require an entirely different construction from ordinary carriages to enable them to run with the necessary velocity and safety. We shall notice first the wheels and axles, then the trucks, brakes, and couplings. The wheels and axles are of primary importance both as regards the safety of passengers and the durability of the cars. Constant efforts have been made to obtain a cast-iron car-wheel without flaws, and of sufficient strength to withstand the shocks to which it is exposed; but it would seem that this has never yet been accomplished, although the desired end has doubtless been approached. It is necessary in the first place that the rim or tread of the wheel be very hard, otherwise it would soon wear uneven from constant contact with the rails, and become

useless; on the contrary, it is necessary that the other parts of the wheels, the nave, spokes, &c., should be annealed, to avoid the constant breakage which would otherwise result. It has been attempted to accomplish these two ends by casting the tire or tread of the wheel in contact with a ring of iron, which *chills* and very much hardens this part of the wheel, while the spokes and nave were cast in sand and permitted to cool gradually, the ring or band of iron called the *chill* being laid into the mould of sand, so that the whole wheel was cast together. The unequal contraction of the iron, however, in the rim and spokes in wheels cast in this manner has thus far prevented the attainment of a perfectly safe cast-iron wheel. Cast-iron wheels have been hooped with a tire of wrought-iron, shrunk on while hot, or secured with screws or bolts. The wheels have also been made entirely of wrought-iron, by uniting the separate portions of the wheel by welding or otherwise; sometimes the tire has been made of steel, at others the body of the wheel has been made of wood suitably combined with iron; indeed countless combinations of wood, steel, wrought and cast iron have been tried in the effort to obtain a cheap, durable, and safe wheel. *Pl.* 5, *fig.* 13, is a portion of a wrought-iron wheel and axle; *b c* is the axle, *a* a spoke welded to the nave, which is made in one piece with the axle. These wheels are safe but expensive, and are much used upon passenger cars in England. In America cast-iron is very generally used; it is more durable upon the tread, but more liable to break than wrought-iron. *Fig.* 14 is a section through a wheel in which wooden spokes *b* are introduced between the rim *c* and nave *a*, a plan not now much used. The diameter of car-wheels is usually three feet, with a thickness upon the tread of three or four inches.

Railroad axles are of wrought-iron, and require to be carefully proved before being put in use, as a small flaw may cause a breakage, and consequently loss of life and property.

The bearings or gudgeons are turned cylindrical and run in composition boxes, which must be capable of carrying a supply of oil for lubricating the bearing parts and preventing undue friction. When this has not been attended to with care, the heat has become so excessive as to melt the brass bearings above the journals.

Pl. 5, *fig.* 15, represents a journal-box of approved construction in longitudinal section. Here the oil is placed in a vessel in the top of the box, and is permitted to drop slowly upon the axles through the hole *h* in the bearing, from the end of a wick, the other end of which is in the oil-box above. The oil that drips from the journal is drawn off from the bottom of the box and may be used a second time. *Pl.* 5, *fig.* 16, shows a method of keeping the journal always lubricated without the use of the wick and without waste of oil; the ring *g* is turned upon the journal and descends into the box below the level of the surface of the oil, which is poured in at the opening *i*.

The bodies of the cars are variously constructed according to the use to which they are to be put, whether they be for the transportation of passengers, freight, or animals. The passenger-cars are differently constructed upon almost every railroad. In Europe there are three or four classes of cars, and

the most convenient arrangement is there thought to be a division of the car into three or more separate apartments, holding eight to ten persons each, as seen in *pl.* 5, *figs.* 24 and 25. In the United States, however, most of the cars at the present time have but one apartment, the seats being arranged transversely two upon each side of a centre passage. In Europe the first-class cars are fitted up with great elegance. *Fig.* 29 shows the interior of the Duke of Brunswick's car upon the Brunswick railroad, and *fig.* 30 Queen Victoria's car upon the London and Dover railroad.

For the transport of merchandise which must be protected from the weather long tight cars closed on every side are used, as seen in *figs.* 27 and 28. For the transport of sand and other materials not injured by the weather, cars are used with low sides and without roof; *figs.* 22 and 23 show a car for the transport of wood. For the transport of animals cars formed of slats or grating are used; they are also furnished with rings to which to secure the animals.

The car *trucks* are of the same size in all passenger cars. The height of the wheels is always 3 ft., and the carriage frame rests upon springs which are secured to the journal-boxes, as shown in *pl.* 5, *figs.* 22–24 and 27. A species of spring much preferred at the present time is seen in *fig.* 18; this spring gives a particularly easy motion to the cars. The spring *b* consists of a single piece of steel and is secured to the main frame *f* at *g* by means of a link joint, and to the axle-box at *c; dd* are chains which unite the ends of the springs and secure them to the axle-box. At first it was presumed that these springs would be easily broken, and to guard against this, the additional springs, *e*, were applied.

Pl. 5, *fig.* 26, shows a portion of the frame of a passenger car as sometimes constructed; it consists of the timbers, *ff* and *g*, strengthened longitudinally by the centre beam *dd*, and also by the diagonal braces *e;* the steps *i i*, for the accommodation of passengers, are secured to the frame. To neutralize the effect of the concussions of one car against the other while in motion the so-called *buffers* are applied to each end of the carriage frame: these are leather cushions upon the ends of rods, *b*, which rods are attached to springs, *a*, beneath the body of the carriage. The buffers receive the shocks and prevent them from annoying the passengers. In freight wagons the springs are dispensed with, and only the leather cushions are used. In eight-wheel cars it is necessary that the wheels be permitted to accommodate themselves to the curves of the track, to a degree which would be impossible were the axles secured rigidly to the car-frame. Without some provision of this kind great friction and a speedy destruction of the rails and wheels would result. To effect this flexibility the wheels are secured in small frames called *trucks*, upon the centre of which the main car-frame is permitted to pivot, as seen in *pl.* 5, *fig.* 27; *figs.* 17 *a* and 17 *b* show an arrangement for accomplishing this purpose, contrived by Ross Winans, an American engineer, at the time of the introduction of eight-wheeled cars; *fig.* 17 *a* is a bolster secured beneath the main frame of the car with the ring-bolt *d* projecting downwards, and into a cavity in a corresponding bolster (*fig.* 17 *b*), which is secured to the centre of the wheel-truck. This

arrangement permits the wheels to accommodate themselves to the curves of the track, without reference to the main body of the carriage.

In order to arrest the cars when it is necessary to stop, or to check their progress in descending inclinations upon the road, *brakes* become necessary; they consist of blocks of wood which are pressed against the rim of the wheels by an arrangement of levers, or in any other manner, and thus produce sufficient friction to arrest or at least to retard the motion of the cars. The simplest form of brake is seen in *pl.* 5, *fig.* 22; the lever, *b*, is so connected with the brake block, *c*, that when the lever is depressed the block is pressed against the wheel, but when the lever is raised to the position indicated by the dotted lines the block is removed from contact with the wheel, which is left free to revolve.

A brake of different construction is seen in *fig.* 9, in which motion is communicated to the brake blocks *ff* by the lever *g*, through the joints *cd*, the one being pressed forwards and the other backwards. In this manner by a slight modification all the brakes of a six or eight-wheeled car may be applied at once; in *fig.* 27 is seen a brake of this description. *Fig.* 19 shows a brake of different construction; *kk* are the brake blocks, secured to the rack bars *ii*, which engage with a cog-wheel upon the upright axle *h*; upon this axle there is a bevel wheel, which gears with a similar bevel wheel upon the shaft *f*, which is in a similar manner connected with the crank *e* above, and thus upon turning the crank the brakes are applied to the wheels, the one forwards and the other backwards. In this same figure is seen a peculiar method of applying springs to buffers. The buffer-rod *a* is attached to the bent lever *b*, one arm of which is connected with the spring *d*, through the rod *c*. When two cars strike together, the rod *a* is forced in, and by means of the bent lever and connecting-rod the force of the blow is transmitted to the spring *d*, which thus neutralizes the shock and returns the buffer to its place when the pressure is removed.

In order to connect several cars into one train, coupling bars or chains become necessary; sometimes these are attached immediately to the car frames, at others to springs upon the frame as in *pl.* 5, *fig.* 26; the coupling-chain is hooked into the hole *h* upon the end of the bar *d*, which is attached to the small pair of semi-elliptical springs which afford a certain degree of elasticity to the connexions, and prevent the disagreeable jars which are experienced in starting and stopping where the couplings are rigid. Sometimes the chain-couplings are drawn together by means of screws until the buffers touch, in order in passenger cars to diminish the unpleasant jolting of the cars against each other; at the short turns in the road this arrangement, however, has a tendency in conjunction with the centrifugal force to throw the cars off the track, or at least by increasing the friction to injure the roads, cars, and locomotives. A plan of this coupling is given in *pl.* 5, *fig.* 20, and a side view in *fig.* 21; *aa* are the coupling-chains attached to the end hooks of the car at *d*; the buffers *b* are brought in contact and the arm *t*, attached to a right and left screw, is turned until the semi-elliptic springs (*fig.* 26) are slightly strained, and the lever is suffered to fall into a vertical position, the weight *w* upon its end keeping it from rising.

4. Inclined Planes. Where a considerable rise is to be overcome in a railroad route, it is often preferable to concentrate the ascent at the termination of the route, instead of equalizing it through the whole length of the road. Various methods have been adopted for overcoming these steep ascents, and we will describe some of the most usual of them.

a. Self-acting Roads. Where loaded cars descend an inclined plane they are often made to bring up the empty cars; such roads are called by the English, self-acting roads. The motion is communicated by means of a rope or chain to which the cars are attached. This rope or chain runs in the middle of the road upon rollers (*pl.* 4, *fig.* 14, G), and upon the upper end it passes over a drum or wheel (*fig.* 13) which lies beneath the surface at the top of the ascent. This wheel is from 6 to 16 feet in diameter, and revolves in a masonry chamber, over which are strong timbers which serve to carry the rails. Usually there are two roads side by side upon the ascent; when therefore the loaded cars are upon the left track at the top, the empty cars are upon the right track at the bottom, and as soon as the full cars are permitted to descend, they draw the empty ones up upon the other track. If the descent is so steep that danger is to be apprehended from the accelerated motion of the descending cars, a brake is applied to the large drum at the top, by means of which the motion is moderated and controlled. The rollers upon which the rope runs are formed in a variety of ways: *pl.* 3, *fig.* 19, is a plan of a roller used upon the Düsseldorf and Elberfeld inclined plane; *fig.* 17 a side view of the roller and the box in which it runs; *fig.* 18 is a longitudinal section upon A B of *fig.* 19; *fig.* 20, cross-section on C D, *fig.* 19. The case, *a*, is secured to the timbers, *e*, *e*, and contains the bearings, *c*, of the roller *b*, which is of cast-iron, the axle being of wrought-iron, and of a size according with that of the rope which it has to carry. The size and quality of the ropes upon an inclined plane are of the first importance. Wire ropes are at the present time almost exclusively made use of, and as these may sometimes break, it is necessary to have the means at hand instantly to stop the descent of the cars; this is accomplished by brakes. To the ascending cars, however, a self-acting arrangement is applied in the following manner: behind the last car hang one or more bars, 6 to 7 feet long, and 3 inches square, suspended to the car at one end, and shot with iron at the other. These bars trail after the car; and in case the latter attempts to descend, the point of the bar enters the ground and holds the car stationary.

b. Inclined Planes with Stationary Engines. It is almost exclusively in mines that a counter-weight can be depended upon to modify the motion of the descending cars; in other cases, where a loaded train of cars is to be raised or lowered, some other power must be resorted to, and this is usually steam. A short distance from the top of the plane is a drum, *o* (*pl.* 3, *fig.* 16), lying horizontally with its axis perpendicular to the direction of the rails; attached to this drum is a cog-wheel which engages with a pinion, upon the shaft of which is a fly-wheel and clutch; the shaft is driven by a steam-engine. The drum turns upon a cylindrical axis, from one end to the other of which it may be moved by a lever; it has also a brake attached to it, by which its motion may be controlled.

If the inclined plane has only a single track, as seen in *pl.* 4, *fig.* 7, turn-outs must be arranged at the top, the middle, and foot of the plane, that the ascending and descending cars may cross each other. When loaded cars are to ascend the plane the end of the rope is attached to them, the drum is turned, and as the rope is wound upon it the cars ascend.

When cars are to descend the plane, whether they be loaded or empty, they are in like manner attached to the rope and suffered to descend, the drum being uncoupled from the engine and the motion regulated by the brake.

When the inclined plane has a double track, as is necessary upon roads where there is a great deal of travel, two drums are required, the one for the ascending trains, the other for those descending. The arrangement of the tracks is the same as for self-acting planes.

Where the plane has so little inclination that the descending cars cannot move the heavy cable, it becomes necessary to attach a second rope to the foremost of the descending cars, while the other end, after passing over a roller at the foot of the ramp, is secured to the last of the ascending cars, and thus the engine carries the ascending cars up, and the descending ones down.

A similar plan is adopted upon the inclined plane in the great Liverpool tunnel, to move the cars in each direction (*fig.* 12). An endless cable passes first around the vertical drum, A, which has two grooves upon its surface, thence diagonally to a smaller drum, *a*, then half round the pulley, *c*, past the pulley, *a*, again, and diagonally across to the lower groove in the pulley A, thence along the centre of one of the tracks, over the large wheel, B, and along the centre of the other track again.

The cable, by the hygrometric changes of the atmosphere, is liable to contraction and expansion, to compensate for which, and to keep it constantly tightened, the roller, *e*, is placed upon a carriage running on rails, which is drawn back by a heavy weight, the suspending cord of which passes over the pulley, *d*, and thus the cable is kept uniformly tight through all weathers, moist and dry.

A steam-engine at the top of the ramp gives motion to the drum A, and the cable receives a constant motion up one track and down the other. The cars are attached to the cables by smaller ropes.

In a similar manner a line of horizontal road may be worked with stationary engines.

The road is divided into distances of 500 to 600 rods, and at the termination of each stretch there are a double track and a stationary engine. The drums at the stations A B C (*fig.* 11) are run alternately first in one direction, then in the other. D and E are the trains drawn in the direction of their arrows by the cables *h* and *k*, upon the drums *o* and *q*, and dragging after them the cables *i* and *g* from the drums *m* and *n*, which are uncoupled from their respective engines A and B.

Instead of running the two drums of each machine one after the other, they may be run at the same time, but then a double track with crossings becomes necessary, as seen in *fig.* 10.

Pl. 3, *fig.* 13, shows the engine-house of the Düsseldorf and Elberfeld inclined plane, *fig.* 14 a plan of the same, *fig.* 16 a view from above of the main drum and parts connected therewith, and *fig.* 15 a cross-section on the line, C′ D′, of *fig.* 16. Here the drums do not lie in the prolongation of the plane, as in *pl.* 4, *figs.* 9 and 16, but perpendicular to the same; *o*, is the main drum, driven by the steam-engine; from this drum the cable runs over the two inclined intermediate wheels, *p* and *q*, and thence over the rollers, *c r* (*fig.* 15), to the railroad track. *Figs.* 17, 18, and 19, are the cable-rollers, as already more particularly described. In *fig.* 14 are seen upon the left the two steam-engines which operate upon the crank-axle, *k*, upon the other end of which is the fly-wheel, *n*, and the main drum; *o b c d e*, are water and steam-pipes to and from the boiler-room and the well, *a*.

5. Suspended Railroads. These were first suggested in England by Palmer, but have never been introduced to any extent. A road of this kind was used at the building of the military works at Posen, and as its construction is peculiar, we will give a short description of it. *Fig.* 21 is a side-view of the car and road; *fig.* 22 an end view of the car, with a section of the rail. At *y* in *fig.* 21 is seen the end of a second car attached to the first. The road consisted of a continuous wooden sleeper or beam, B, having an iron rail, C, upon its top, and supported upon posts, A. The cars were balanced upon each side of the road, and were supported upon the top rail, C, by a grooved roller, H. To the sides of the posts, A, were secured bars, G, having each an iron rail, J, in its centre, against which the body of the cars rests either with or without friction-rollers. Where horses are the moving power, they are to travel one upon each side of the road.

6. Atmospheric Railroads. The many accidents which occurred when railroads were first introduced, and the great expense of running locomotives, made it very desirable that the latter should be dispensed with, and that a cheaper and safer motive power should be found to take their place. Compressed air was thought of, and experiments were made to render this available, but without success. Rarefied air was then thought of; and Vallance, an Englishman, suggested a large hollow cylinder of sufficient capacity to contain the whole train of cars within its interior; in advance of the train, and attached thereto, there was to be a piston sufficiently large to fill the cylinder, from one side of which the air was to be exhausted, and the pressure of the air upon the other was to drive it along, together with the train attached to it. The proposition carried upon its face entire impracticability, and was never acted upon.

The same idea was however afterwards carried out with considerable modification, and an experimental tube was laid near London, 1200 feet long and 9 inches in diameter; a 16-horse steam-engine was used to pump out the air from the tube. The result of this experiment being entirely satisfactory, the system was put into practical operation in Ireland upon a branch of the Dublin and Kingstown Railroad. This branch, with the Croydon and South Devon Railroads in England, and a few minor trials in France, are the only ones ever constructed upon this plan. The

branch of the Dublin road to Dalkey was full of curves and inclinations which rendered the use of a locomotive perfectly impracticable; it was opened in December, 1843, and still continues in operation.

In *pl.* 6, we have represented the Kingstown and Dalkey Railroad, and shall explain its construction sufficiently in detail to manifest the principle upon which it acts. In the centre of the track is laid a hollow cast-iron cylinder, which is secured to the sleeper by bolts and screws (*figs.* 2 and 4). The joints of the cylinder, where the separate pieces come together, are made air-tight, and are firmly secured by screws. Within the cylinder, which is 15 inches in diameter, moves a solid piston, B (*figs.* 3 and 4), with an exceedingly elastic packing, that it may adapt itself as nearly as possible to the small inequalities of the interior of the cylinder. The piston is provided with an advancing head, which serves to open the valves, and has attached to it a piston-rod 18 feet long, the central portion of which is a plate, C, balanced by the weight, W, so that the piston always lies horizontal.

The plate C has four rollers, E (*figs.* 3 and 4), the object of which we shall learn hereafter. The driving-piston is connected to the carriage above by the plate D (*figs.* 3, 4, 5, and 6), which, however, must pass through the cylinder, which has a slit running its whole length for the purpose. This it is necessary should be closed air-tight in advance of the piston, and open only at the moment of the passage of the plate D, that the pressure of the air may operate upon the back of the piston. *Fig.* 8 shows the arrangement adopted for this purpose. A is the cylinder, K L the valve, which consists of a strip of stout sole leather covered with a thin plate of steel, surmounted by a cast-iron plate, K, which prevents the valve from being forced into the opening by the pressure of the atmosphere; beneath the valve there is also an iron plate, not shaded in *fig.* 8, but seen in *fig.* 6, which entirely closes the opening in the tube; this latter plate is curved upon the same radius as the cylinder, that the piston may fit air-tight all round. At *l* the leather valve is held firmly, and at L is a trough into which a composition of wax and tallow is poured, which assists to pack the valve air-tight. In order to protect this apparatus from the weather, plates of sheet-iron, H, 5 feet long and hinged at *h*, are made to hang over the whole. To understand the operation of this apparatus, we must turn to *figs.* 3, 5, and 6. The roller, E, upon the piston projects into the longitudinal slit, and raises the valve, K, breaking the wax cement which holds it to the cylinder; at the same time the roller, M, upon the bottom of the driving-car (*figs.* 5 and 6) comes under the plates, H, and raises them, so that the atmosphere is free to press upon the after-surface of the piston, which is thus driven along the cylinder, and with it the driving car, the two being connected together by the plate, D, as seen in *figs.* 1 and 5. That the valve may be returned to its place after the passage of the plate, D, the driving-car carries a roller, F, (*figs.* 3 and 7), which runs upon the surface of the plate, K, and presses the leather, L, again down upon the valve-seat. At the same time, immediately over the trough, L, there passes a tube, G, heated by a small furnace upon the driving-car, which melts the mixture of wax and tallow, and again packs

the valve air-tight. This heating arrangement was subsequently found to be ineffectual and unnecessary, and has since been discarded.

It was doubted at first whether the trains, once started, could be stopped, but it was found that they were perfectly manageable with powerful brakes. In order that the conductor may be informed of the extent of the rarefaction in front of the piston a tube passes through it up into the piston-car, near his seat, where it communicates with a barometer, and he is thus informed of the amount of atmospheric pressure which he at any moment has on; he has also the means within his reach of regulating the speed of the train, and when it becomes too high of admitting air through another tube, which also passes through the piston and comes up near his seat, where it is furnished with a cock; by the admission of air through this tube the speed is soon checked, but the air-pump continuing uninterruptedly at work the vacuum is soon re-established.

The whole length of the line is 3050 yards or nearly $1\frac{3}{4}$ miles, with a rise of $71\frac{1}{2}$ ft. from the commencement at Kingstown to the termination at Dalkey, the average rise being 1 in 140, but the last 365 yards have a rise of 1 in 57. The line is worked only one way by the atmospheric apparatus, the return being effected by the force of gravity.

As stated above the length of the line is 3050 yards, but the atmospheric main is only 2400 yards long, the remainder of the way, 650 yards, being run by the momentum previously acquired. The diameter of the main is 15 inches, and near its extremity branches out a pipe, C (*pl.* 6, *fig.* 2), which leads to the exhausting apparatus, distant 500 yds. The air-pump, which is double acting, is $66\frac{1}{2}$ inches in diameter, with a stroke of 66 inches. It is worked by a high pressure condensing engine with $34\frac{1}{2}$-inch piston and 66 inches stoke, working expansively, the cut-off valve being regulated by a governor, so as to vary the speed of the engine from $\frac{1}{3}$ at the lowest to $\frac{1}{5}$ at the quickest.

At the entrance end, and some thirty feet from it, is a kind of balance-valve, B (*fig.* 2), very ingeniously contrived to open by the compressed air in front of the piston; and at the other or exit end is another valve, opening outwards by means of the compression of the rarefied air, after the piston has passed the tube leading from the main to the air-pump.

2. Bridge-Building.

Bridge-building may, strictly speaking, be considered a branch of road-building, for a bridge is merely a road over a river or a ravine; still it appears to be of sufficient importance to merit a chapter by itself.

The oldest bridge of which we have any information is that over the Euphrates at Babylon, and described by Diodorus, Herodotus, and Philostratus. According to Diodorus it was built by Semiramis, but Herodotus ascribes the building of it to Nitocris, about five generations later, and the probability is that it was repaired or completed by him. The length of the bridge was near 3000 ft.; the piers stood 12 ft. apart in the clear, were of

cut stone and built upon deep-laid foundations, the river having been turned from its bed for the purpose. The stones were bound together with iron clamps set with melted lead. The starlings formed an acute angle; down-stream the pillars were semicircular; the roadway was 30 ft. wide and consisted of cedar and cypress timbers overlaid with palm wood. A draw-bridge was raised every night to break the communication. Without doubt all the bridges of antiquity differed but little in their construction from this.

The Romans are the first the remains of whose bridges have come down to the present time. So great was the importance which they attached to these structures that the supervision of them was intrusted to a priest who received his title therefrom, PONTIFEX MAXIMUS.

Before we enter upon the details of the subject we will lay down certain well established principles respecting the position and construction of bridges, which principles must rest upon the four conditions which should govern all architectural structures: suitableness or convenience, durability, beauty, and economy.

The situation of the bridge should be such at the confluence of streets or highways as to shorten the journeys of the greatest number of individuals without uselessly increasing the number of bridges. The bridge should be located upon a good foundation, and where it is in no danger of being undermined by the water.

The direction of the bridge should correspond with that of the streets leading to it, or nearly so, that the entrance of vehicles may be unobstructed and easy; and its axis should be perpendicular to the direction of the stream, that the bridge may be as short as possible and the piers present their shortest face to the current.

There should not be any considerable ascent or descent from the street to the bridge, while at the same time the bridge must be so high as not to obstruct the water-way.

The width should be such that vehicles may pass each other, while upon each side there must be sufficient room for foot passengers, except in bridges of short span where there is but little travel; in such cases, if two carriages chance to meet at opposite ends of the bridge, one of them may wait, and the roadway may be sufficiently wide only to accommodate one at a time.

The foundations must be well laid and broad, particularly where the ground beneath is not solid, and in such cases they may be carried up in steps, as seen in *pl.* 7, *fig.* 14 *a*.

The form of the bridge must be decided with relation to the material employed and other attendant circumstances, whilst its beauty will result from the proper application of architectural principles.

There are three distinctly different constructions of bridges, according as they are built of stone, wood, or iron.

A. Stone Bridges.

We turn now to the construction of stone bridges, which, from the rudest form of rustic bridge seen in *pl.* 7, *fig.* 1, to the noble structure represented in *fig.* 23, are characterized by a feature common in some shape to them all,

the *arch*, the various forms of which exert an important influence upon the whole arrangement and appearance.

It is the fortune of but few architects to be intrusted with the building of large bridges, and consequently to have experience on this subject.

Perronet in France is amongst the most celebrated of modern bridge-builders, and has planned and erected a great number of important bridges, amongst others that of Neuilly, which will be referred to hereafter, and which has already been mentioned under Architecture, and represented in Plates, Div. VII., *pl.* 60, *fig.* 9. The first step towards the erection of a bridge is to build the piers and abutments; for this purpose, when possible, the bed of the river where the pier is to rest must be laid bare, and we will here exhibit some of the usual methods of accomplishing this and of laying the foundations beneath the surface of the water.

The space which the pier is to occupy is first inclosed with a *coffer-dam*. For this purpose piles are driven into the ground below, inclosing a rectangular space, and four to six feet within these another series is driven; the two walls thus formed are well stayed and strengthened with timbers, and the space between the two is rammed full of puddled clay. Much depends upon the careful preparation of the coffer-dam, as a slight blunder may lead to disastrous consequences, even the entire destruction of the dam.

Under certain circumstances, the dam may be built cylindrical. *Fig.* 5 shows the disposition of the piles and timbers, and *fig.* 6 is a vertical section of the same; a is the outer wall of piles, f the interior piling, and c c' c'' braces for the greater security of the dam. The dam being completed, the next operation must be to empty the inclosed space (*fig.* 4), for which pumping arrangements of some kind are necessary, which are driven by a water-wheel placed in the stream at the side of the dam, or by a steam-engine. It is very seldom possible to lay the bottom dry; so great is the pressure of the water from without, that it is constantly forced up through the bottom of the dam, which obliges the pumps to be kept in operation until the masonry of the pier is completed to a level with the surface of the water. So soon as the bottom of the dam is dry, or as nearly so as possible, the foundation of the pier is commenced, preliminary trials having been made to ascertain the nature of the ground below. If rock be found, the intermediate layer of earth is removed, and the pier is placed immediately upon the rock.

In most cases, however, sand, gravel, or clay is found, and then a framing of timber becomes necessary, which, if the ground below be firm, is laid upon the surface, and covered with a plank floor, upon which the masonry is commenced; generally, however, it becomes necessary to pile the whole area to be covered by the foundation. To this end large piles are driven, at a distance of 2 feet from each other, to such a depth that they can no longer be sunk deeper by repeated blows of the monkey. When the piles are driven, they are all cut off upon the same level, and upon the surface thus produced the floor is laid which is to receive the masonry, the space between the piles and lower timbers of the frame being rammed with clay, stones, &c.; the pier is then raised of cut stone, or, if of rubble, the stone

for the exterior only is cut. So soon as the pier has reached the level of the spring of the arch, the coffer-dam is destroyed, and the water allowed to come to the pier.

It often happens that the stream where the bridge is to be built is so deep or so rapid that no coffer-dam can be built, or that the ground below is of such a nature that timber framing is not necessary; in such cases another method of laying the foundations is adopted, the pier being built in large water-tight boxes, or chambers, called *caissons*, which are afterwards sunk upon the spot where the pier is to stand.

These caissons must be sufficiently large not only to hold the pier, but also to accommodate all the workmen who may be employed upon it at a time. *Pl.* 7, *fig.* 11, is the plan of the bottom of the caisson, which shows the grating or framework on which the masonry is laid. Around the edge of this bottom double water-tight plank walls are built, between which tenacious clay is rammed, and so arranged, that on the completion of the work the sides may be separated from the bottom. *Fig.* 9 is a front view of the caisson, *fig.* 8 is a vertical section. In this caisson, as seen in *fig.* 12, the pier is built, the caisson sinking as the work proceeds until it reaches the ground below. *Fig.* 10 shows a caisson grounded upon the bottom, already prepared for it by divers; here is also seen the manner in which the caisson is stayed to the pier as it sinks into the water. *Fig.* 7 shows the manner in which the piers of Westminster Bridge, London, were built in caissons. When the pier has reached the springing line of the arch, or at least is above the surface of the water, the sides of the caisson are loosed from the bottom, to be used again in the same manner. The arch of the bridge is now to be commenced, but previously the centring, which is to support the *voussoirs* or separate stones of the arch, must be built. The centring must be sufficiently strong to sustain the weight of the whole structure without sinking, until the key-stone is put in, which binds the whole together, and for large bridges must be constructed with extreme care and of great strength; otherwise, as the two ends of the arch are built, the weight of the materials depresses the centring at these points, causing it to rise in consequence in the centre, and the arch of the bridge to become higher or more pointed than was intended. To prevent this, even with the best constructed timbering, the top of the centre should be loaded with stones as the work proceeds at the ends, and the tendency of this part to rise thus counteracted.

Centrings are either supported from below, or are self-sustaining, as seen at *figs.* 16 and 13. Piles may be driven, or small stone pillars may be raised for the purpose, upon which the centring is built; *fig.* 14 shows an arch of London bridge, with one of the centrings resting upon the piles, *a*, upon which are placed the tie-beams, *b*, suspended by the trusses, *d*, *e*; the other struts of the centring, *f*, also rest upon the piles, which thus carry the whole weight of the centring and bridge until the key-stone is in. *Figs.* 19 and 20 represent a supported centring of a bridge built in Berne in 1842; here the support is afforded partly by stone pillars, partly by piles, which carry the temporary bridge for the support of the laborers and materials; the construction of the centring itself is apparent from the draw-

ings. When it is not possible to support the centring from below, it must be made self-supporting, and can only rest upon the pillars at its ends. This problem is one of importance and difficulty, and in large bridges requires an architect of great experience. *Pl.* 7, *fig.* 13, is the centring contrived by Perronet for the very flat arches of the Neuilly bridge. *Fig.* 16 is the centring constructed by Rennie for the new Waterloo bridge in London; the bearing points of the ties and struts are all in iron shoes, to enable them to resist the great strain put upon them. *Fig.* 23 represents Westminster bridge in process of building, together with its centrings. The latter are supported upon a great number of wedges, that any particular portion requiring it may be tightened, and ultimately to facilitate the removing of the centrings when the work is completed.

As the wedges are very easily lost or misplaced, Elmes contrived for London bridge a species of screw wedge, of which a representation is given in *fig.* 15: the wedges *m* and *n* were moved by the screws *l*, and by this means the whole centring was capable of being raised, and ultimately of being lowered; *d* are the shores or supports resting upon the heads of the piles.

In *fig.* 20 are seen the derricks used in laying the stone, also the trucks which bring them to the work upon the temporary working frame; in *fig.* 20 the stones are seen slung in can hooks; *figs.* 21 and 22 represent the ordinary lewis, used where the stone is hung from the centre. A hole, *c*, enlarged at the bottom is cut in the stone, and the wedge, *a*, is inserted; the two cheek pieces, *b*, are then put in, and as the wedge, *a*, cannot be withdrawn by a straight pull, the stone is raised by the hook, *e*. To withdraw the lewis it is requisite only to take out the pieces, *b*, and the whole is loosened.

Formerly the voussoirs of bridges were all of the same height (*pl.* 7, *figs.* 2, 19, and 17, a side view of the Nydeck bridge in Berne), the *extrados* or outer surface of the arch being parallel with the *intrados* or inner surface, as in the Pons Senatorius at Rome. More recently the surfaces of the stones in the vicinity of the key-stone were made horizontal, as in the Pont Royal in Paris, the Neuilly bridge, and many others of recent times. At present the voussoirs are made to increase from the key-stone gradually to the springing line (*figs.* 3, 16, and 18), for the purpose of enlarging the bearing surface of the arch upon the pier. For lightness the bridge is sometimes filled in with minor arches as seen in *pl.* 7, *fig.* 18.

B. Wooden Bridges.

Wooden bridges are characterized by the arrangement of the timbers which support the roadway over the openings to be bridged.

In the simplest form of wooden bridges the roadway is supported upon piles driven into the bed of the river, or upon stone piers, either with or without trussing or framing.

In all wooden bridges of large span the roadway is suspended from trussed frames or wooden arches.

In *pl.* 8, *figs.* 1–8, is represented the bridge over the Rhine at Schaffhausen; this was one of the most celebrated wooden bridges ever built. It was planned and constructed in 1757 by a common carpenter, Ulric Grubenmann, and

was burned by the French in the campaign of 1799. It consisted of two spans of 171 and 193 feet, resting upon an old stone pier which belonged to a former stone bridge upon the same site, and which had been swept away. *Fig.* 1 is a side view with one half of the covering removed; *fig.* 2 a plan of the road timbers; *fig.* 3 a plan of the roof; *fig.* 4 a cross-section; *fig.* 5 a view of one of the hollow suspension frames; *fig.* 6 a section of the roof; *fig.* 7 a portion of the notched girders; *fig.* 8 a perspective view of the joints used for uniting the separate pieces of the above. From these figures the construction of the bridge and the arrangement of the timbers are apparent. Originally it was intended that the bridge should stand without the pier; this was suffered to remain, however, and some years later Grubenmann, fearing that it might also be carried away, added the braces, *b*, *f*, seen in *fig.* 1, for the purpose of making the bridge independent of its central support.

A bridge over the Limmat, near the Abbey of Wittengen, was also erected by the same carpenter, assisted by his brother John Grubenmann, and burnt soon after that of Schaffhausen; it consisted of one opening of 390 feet span, with a rise of 43 feet, and was a more solid and even a superior piece of carpentry to that at Schaffhausen. This was the greatest span ever executed with timber. Its radius of curvature or curve of equilibrium was about 600 feet.

Fig. 9 shows an arch of peculiar construction of the viaduct over the valley of the Ouse, on the North Shields and Newcastle railroad; *fig.* 10 is a cross-section of the same; *fig.* 11 a view from above of one of the piers, showing the arch upon one side and the road timbers upon the other; *fig.* 12 is a side view of a portion of the pier A, with the foot of the arch B; *fig.* 13 a vertical section showing the manner of uniting the planks; *fig.* 14 is a cross-section showing the connexion between the arch and the braces; *fig.* 15 is a front view of a pier A, with the cast-iron shoe in which the arches B rest; *fig.* 16 is a view of the said shoe, C; *fig.* 17 *a* longitudinal section of the same; *fig.* 18 transverse section of the same, with the clamps which secure it to the pier A; *fig.* 19 is a section of the top of a pier, showing the road timbers and railing; *fig.* 20 shows the manner of bolting the ribs beneath the roadway F and E to the crown of the arch; *fig.* 21 shows the connexion of the roadway H with the railing D at a point immediately over the crown of the arch B, over which the timbers E and F meet; *fig.* 22, cross-section of this joining on a larger scale; *fig.* 23, side view of the same; *fig.* 24, section of joinings of these timbers; *fig.* 25, the joint between the timbers F and E and the cross-ribs; *fig.* 26, joint between the rib G and the flooring; *fig.* 27, detail of the connexion between the timbers E and the pier A, and by means of the cross-ribs L with the arch B, also through the carriers O with the longitudinal timbers of the roadway; *fig.* 28, section of the foundation piles, with the platform and grillage.

Another bridge with a notched timbered arch deserves to be mentioned in this place. This is a bridge over the Schuylkill at Philadelphia, covering an opening from one abutment to the other of 340 feet 3¾ inches. *Pl.* 8, *fig.* 29, is a view of the bridge, with the covering removed from the left half

to show the arrangement of the timbers. The boldness and simplicity of this bridge are equally to be admired. The greatest part of the thrust and the whole weight of the covering are thrown by the framework *a b* upon the abutment *e* and the timbers *d c c′*, whilst the arch has only its own weight and that of the movable load to support. In 1838 this bridge was burned, and its place is now supplied by a wire bridge of single span.

A new system of bridge-building recently come much into use should be here mentioned; it was invented by Laves, chief architect to the court of Hanover. Laves had already invented a peculiar method of building beams, by which he had attained great strength at comparatively small cost. The girders were sawed longitudinally each way from the centre to within two feet from the ends, as seen in *fig.* 35. At each end where the cut commences the girder is bound with iron rings, *a*, two inches wide and half an inch thick, to prevent the entire splitting of the timber. The two portions of the bridge were then driven apart by wedges, *b*, and a girder was obtained, having all the strength of a flat arch without the thrust, only wall-plates A B being required to give the ends an even bearing. Shortly afterwards the inventor carried the idea further and constructed his girders of two timbers notched together at the ends, *fig.* 36; as in the former case no abutments were required and no thrust was exerted.

Subsequently this method of construction was extended to bridge-building by the inventor. The principles of the application will be made apparent by an inspection of *pl.* 8, *fig.* 30, the cord below being united with the bridge by the braces *a c* and *b c*, whilst the diagonal braces serve to render the structure self-sustaining and stiff.

The same system, carried out with rather more attempt at beauty and ornament, is seen in *figs.* 31 and 32; *fig.* 33 is a cross-section, and *fig.* 34 a plan showing the arrangement of the braces. This system would be very limited in its capabilities of extension were it confined to a single beam; this is not the case, however. Any number of beams may be scarfed together, as seen in *figs.* 37 and 38, to form either the roadway or the tie-beam beneath. In *fig.* 39 is seen the method of giving the ends of the bridge-frames a solid bearing upon the abutments. *b* and *a* are the upper and lower timbers bound together by iron rings, *d d*, and *c* are wedges also notched to the lower beam and which serve to give it a firm bearing upon the head of the pier. *Fig.* 40 is a section through an arch of this description; *a* and *b* are the timbers, and *g* the blocks which serve to keep them in their places. A large bridge built entirely upon this principle is seen in *fig.* 41; *fig.* 42 is a plan showing the diagonal braces, and a portion of the road covering; *fig.* 43 a cross-section of the bridge; *fig.* 44 the scarfing of the timbers of the tie-beam; *fig.* 45 the joint at the end where the girders rest upon the abutment.

C. Iron Bridges.

When the arch of a bridge is constructed of iron it is called an iron bridge, although the piers and abutments may be of stone and the floor or roadway of wood. These bridges are variously constructed; in very short

spans the arch may be cast in a single piece, in larger spans it may be cast in many pieces and united by bolts, or voussoirs may be cast and set after the manner pursued with stone bridges, or the roadway may be hung upon chains or even wire cables. Desaguiliers and Garrin, in the commencement of the 18th century, proposed the building of iron bridges, but the idea was first carried out in England. The first iron bridge was that over the Severn near Colebrookdale, erected in 1779. *Pl.* 9, *fig.* 1, is a view of one half of the arch; *fig.* 2, a cross-section; *fig.* 3 is a plan with the roadway removed; *fig.* 4, a plan of the springing plates on which the arch rests; *fig.* 5 shows the fastenings of the diagonal braces, E, of *fig.* 3 with the main arches; *fig.* 6, the connexion between the cross-braces and the arch ribs. These figures are so clear that they require no further explanation. The bridge is one arch of 100 ft. 6 inches span and 45 ft. high from the level of the springing-plates to the middle of the soffit. The height from ordinary low water to the springing-plates is 10 ft., making the whole height from low water to the soffit 55 ft.

The bridge was designed and executed by Abraham Darby and formed a new era in bridge building. The form of the intrados is nearly a semicircle and consists of five ribs, upon each of which rests one of the longitudinal stringers which support the roadway. Upon these stringers are placed iron plates 2½ inches thick, which support the road-covering, consisting of clay with broken iron cinders.

Soon after the completion of the above bridge the second iron bridge was built, three miles higher up the Severn. The engineer, Thomas Telford, a county surveyor, introduced the principle of suspending the bridge upon two large ribs, one on each side of the bridge. The span is 130 ft., the versed sine of the ribs which bear the covering plates is 17 ft. and the breadth across the soffit is 18 ft.; the height from ordinary low water to the soffit is 34 ft. *Fig.* 14 is a side view of this bridge; *fig.* 15 is a cross-section of the same; *fig.* 16, a plan of the springing-plates; *fig.* 17 shows the connexion and bracing between the main arch B and the intersecting arch C, by the upright braces *a* and diagonal braces *b*; *fig.* 18 shows the connexion of the railing with the bridge road, and *fig.* 19 shows the connexion of the two arches at the crown. It will be perceived that the auxiliary arch is for the purpose of supporting the main arch at its weakest point, the latter being suspended by iron straps to the auxiliary arch. The cost of the bridge, including the abutments, was £6000 sterling.

The third bridge in regard to time and progressive increase of magnitude was that over the Wear at Sunderland, in the county of Durham. The arch is the segment of a circle, the chord being 236 ft. and the versed sine or height of the crown of the intrados above the level of the springing line 34 ft., so that the largest ships may pass beneath it.

It is of the boldest construction, and is put together very differently from those already described, the arches being composed of open-work boxes or gratings, which take the place of the voussoirs in a stone arch. *Fig.* 7 is a side view of the bridge, and *fig.* 8 a perspective view of one end; *figs.* 9 and

10 show the open work of arches upon a larger scale; *fig.* 11, the vertical bars uniting the three ribs of the arches, whilst the latter are firmly stayed together by the transverse rods (*fig.* 12). In the sunken panels of the ribs, *a* (*fig.* 10), over the vertical joints between the voussoirs, lie wrought-iron plates (*fig.* 13), which are screwed to the ribs and bind the voussoirs firmly together.

A peculiar construction of iron bridges was introduced in 1837 by a French architect, Polonceau, who built upon this plan the Carrousel bridge in Paris. In this construction the strength of iron is united to the elasticity of wood. The arches of the bridge consist of hollow cast-iron tubes filled with wood and imbedded in asphaltum. *Fig.* 20 is a view of this bridge, which consists of three arches, with stone abutments and piers. Upon each askew-back are five cylindrical boxes or springing-plates, into which the arch ribs are set (*fig.* 32). These ribs consist of elliptical tubes composed of two pieces, one of which is seen in *fig.* 26 in various views and sections. The two halves united are shown upon a large scale in *fig.* 25, in which the plank filling is seen. Between each layer of wood is a thick layer of asphaltum. The semi-cylinders are united together by screws (*pl.* 9, *fig.* 25); *fig.* 21 shows the foot of the arch upon a large scale. The large rings between the arch and roadway are seen in section in *fig.* 29 and in elevation in *fig.* 30, from which the connexion between the rings is apparent; *fig.* 31 is a horizontal section of one of these rings; *fig.* 23 is a view from above of the ribs of the arch, the roadway being removed, and showing the diagonal braces, K, and the transverse braces, L; *fig.* 22 is a vertical section of the arch of the bridge; *fig.* 28 shows the connexion between the diagonal and transverse braces with the ribs of the arch. The stringers *b* (*fig.* 24) are borne in iron shoes (*fig.* 27) by the five arch ribs and the supporting-rings D; the stringers are made in two parts screwed together, and the two outside stringers are covered with iron plates, *o* (*fig.* 24). Above these stringers come the transverse sleepers of the roadway, *a*, carrying the console plate G, the elevated foot-walk being supported by the tringle K, the support *l*, and the bearer *h*. The sleepers also carry the iron plates, *e*, which support the foundations, F and G, with the road-covering above. *Fig.* 22 shows the whole roadway in section.

For laying the arch ribs, C, a peculiar centring was constructed (*fig.* 33), resting upon two temporary piers; the ribs were supported upon this centring, on blocks and wedges, where they were filled with the wooden plates, screwed together, and secured in place.

Of an entirely different character from the bridges described above are those in which the roadway is suspended from chains or wire cables, stretched from the top of towers or tall piers. The suspension system, though new in Europe, has been long known in India and America; to the English, however, is due the credit of having perfected the system, which rests upon the properties of the so called *catenary*, that is the curve which a thread takes when suspended at both ends and left to itself. If now in lieu of the thread, two chains or wire cables be imagined suspended at a distance from each other equal to the width of the bridge, with the roadway suspended

horizontally by rods of different lengths from these cables, we shall have the rough idea of a suspension bridge.

At first chains were used for this purpose, made something after the manner of watch chains with links 10 to 15 feet in length, but it was found that cables made of a great number of iron wires bound together were preferable on many accounts to chains, which they have almost entirely replaced in the construction of suspension bridges.

By means of bridges upon this principle distances are now spanned, and ravines and gorges bridged, which before their introduction were never attempted.

The difficulties of constructing a bridge across the Danube have long been considered insurmountable; the current is very rapid, and the least depth of water is 20 feet, while at times the water rises 36 feet above low-water mark, bringing with it immense masses of ice which break down embankments and carry away whatever impedes its progress. Suspension bridges have, however, been found to be perfectly practicable; and one constructed at Pesth by an English engineer is said to be the first permanent bridge erected over the Danube below Vienna for upwards of seventeen centuries. It was opened for the first time on the 5th January, 1849, and the same day was put to the severest test to which the stability of a bridge can be subjected, by the retreat of the Hungarian army over it, followed by the Austrians. The passage over the bridge is thus described in a letter written from the spot. "First came the Hungarians in full retreat, and in the greatest disorder, hotly pursued by the victorious Imperialists; squadrons of cavalry and artillery in full gallop, backed by thousands of infantry; in fact the whole platform was one mass of moving soldiers; and during the two first days 60,000 imperial troops, with 270 pieces of cannon, passed over the bridge." This fact is of the first importance, as it proves that suspension bridges, when properly constructed, may be erected on the most exposed situations, while their cost is small in comparison with that of stone bridges. It should be mentioned in connexion with the above, that the marching of a close column of infantry is considered to be the severest test to which a bridge can be subjected. The distance between the points of suspension of this bridge is 665 feet, and the platform is 42 feet wide. This is the first bridge with stone piers built between Ratisbon and the Black Sea since the time of Trajan, A. D. 103, when a bridge was built across the Danube near the confines of Hungary and Servia, the ruins of which are still pointed out.

At Vienna a steel suspension bridge has been erected over the Danube, the span of which is 234 feet. It is calculated that the weight of the steel in the bridge is only one half that of the iron required to build a bridge of equal strength.

The first suspension bridge in England appears to have been erected over the Tees, for the use of the miners in 1741. The most noted of this description in England is the chain bridge over the Menai straits, which separate the island of Anglesea from the county of Caernarvon.

The main opening is 560 feet between the points of suspension; in addition there are four arches on the western side and three on the eastern

side of the principal opening, each of 50 feet span. The under side of the roadway is 100 feet above the high-water line.

In France wire suspension bridges have been extensively introduced. In the United States also suspension bridges have been erected to a limited extent. At Philadelphia there is a wire suspension bridge over the Schuylkill upon the site of Wernway's wooden bridge, burned in 1838. At Wheeling, over the Ohio, one of the finest structures of this kind in the world has been erected by Mr. Charles Ellet, Jr., with a span of 1,010 feet, which is 152 feet longer than the celebrated bridge at Freyburg, which has the greatest span heretofore constructed.

The flooring of the Wheeling bridge is 24 feet wide, and is suspended from twelve cables of iron wire 4 inches in diameter, and 1,380 feet long.

The same architect has also constructed a suspension bridge over the Niagara river, between the falls and the whirlpool, and in sight of both; the span is 800 feet, and the roadway 230 feet above the surface of the river.

Thus it will be seen that distances have been spanned by suspension bridges far exceeding anything even attained by any other species of construction, while the experiments made by Vicat during an examination of the state of the suspension bridges over the Rhone lead to the conclusion, that with proper care they will prove as durable as the most solid stone structures. It is to be regretted, however, that they do not afford that stability which is necessary to enable them to be used as railroad bridges.

A few years ago it became necessary to construct a bridge over the Menai straits for the passage of the Chester and Holyhead Railway. It was impossible to make use of the chain suspension bridge, as was at first intended, its flexibility rendering it unsuitable to the passage of trains of cars. It was also necessary that no centring or scaffolding should be used, as this would interrupt navigation; a stone bridge was therefore out of the question.

Mr. Stephenson offered a design of an iron tube, a proposition which was received at the time with general incredulity; the company, however, having confidence in their engineer, after some preliminary experiments, decided to adopt the plan, and it has since been built. The tube is not cylindrical, but rectangular; it is constructed of thick plates of boiler-iron, and is made of several sections resting upon piers. The distance spanned by the longest section is 460 feet clear, the greatest distance ever yet attempted except in suspension bridges. One of the longest sections is estimated to weigh 1600 tons. These tubes were floated upon pontoons to near the position they were to occupy, and raised to their place by huge hydraulic presses. The trains pass through the interior of the tubes.

3. Inland Navigation.

Hitherto we have treated of communication by land only; but streams also form an important means of communication wherever they are capable of bearing shipping. All streams, however, are not adapted to this pur-

pose, some being either too shallow, or having many small crooked windings, which retard the current and cause bars; and in others the current is so swift as to render navigation dangerous. In all such cases certain works are necessary to render the streams navigable. By cutting off the small windings, and giving a river a straight course, the current will be increased and the formation of bars prevented. When the channel of a river is obstructed by rocks they may be removed by blasting; where it is generally too shallow to bear vessels, successive portions of it are dammed up in order to obtain sufficient depth, the vessels entering the successive *reaches* by means of locks. Canals are constructed for the purpose of inland navigation, where no natural means are available, or to connect one stream with another. Some of these structures we will now proceed to consider in detail.

A. Dams.

When shallow streams are to be made navigable by means of dams, the latter are built of a height sufficient to maintain the depth of water required for navigation, and allowing the surplus water to run over the top, on which account they are called *overfall-dams.* They are built of wood or stone. In building wooden overfall-dams, large beams of timber are first laid in several contiguous rows across the bottom of the stream, and are firmly settled into its bed. Upon these sills are laid successive rows of beams, breaking joints, and planed throughout on the horizontal faces so as to prevent leakage; they are pinned together with treenails both vertically and horizontally, and the interstices between the vertical faces are closely packed with clay and sod. The sides of the dam are sloped towards the top, the pressure sustained at the bottom being much greater than at top; that face which slopes against the current is called the *breast;* the downward slope is called the *apron.* To protect the breast from being undermined, a double row of thick plank is driven into the bed of the river above the breast. For the protection of the apron, piles are driven, on which a hearth of thick plank is laid to receive the fall of water, or else a bed is made of rocks firmly packed between the piles.

On *pl.* 11, *figs.* 16, 17, and 18, is represented a wooden overfall-dam across the river Witogra in Russia. This river being large and rapid, a very wide base has been given to the dam. The mode of construction is different in some respects from that above described, as is seen in the cross-section (*fig.* 17). The base consists of piles and grillage; the breast, F, is made by driving piles of different lengths so as to form the required slope, across which the breast-sills are laid, on which are spiked heavy oak planks closely fitted. A bulkhead of timber is built into the bank on each side of the dam, to prevent the water from passing through. Below the dam strong piles are driven into the bed of the stream, and between them large stones are packed to receive the shock of the falling water, and prevent the undermining of the dam.

The upper surface of the dam is sloped in the direction of the current; thick planks are spiked upon the dam-sills, and their joints caulked and

covered with laths. In order to have the means of regulating the height of water, frames with flood-gates A A′ A″ (*figs.* 17 and 18), are built on top, and between these frames and the sides bulkheads are built to the height which the water is to assume when the gates are closed.

Stone overfall-dams are built massively of heavy dressed stone, on a foundation of piles and grillage, unless the bed of the river is rocky. The stones are clamped together by brass clamps, to prevent their being displaced separately. A stone dam, built by Smeaton, is represented on *pl.* 10, *fig.* 15 being a top view, *fig.* 16 one half of a longitudinal section, and *fig.* 17 a cross-section.

Between the two slopes of stone dams an open space is sometimes left, which is lined with two rows of closely fitted planks, and then filled up with rammed clay, in order to oppose an impermeable barrier to the water which may pass through the joints of the walls. Stone dams are protected against the undermining action of the water in the same manner as described in speaking of wooden dams. The form of an arch, with the convexity up stream, is often given to stone dams (*pl.* 10, *fig.* 15), by which they are enabled better to resist the action of the current.

B. Canals.

Canals are open trenches filled with water from lakes, streams, or springs, to a sufficient depth to bear loaded vessels, thus affording a means of inland navigation. They are formed either by excavations in the solid earth, or by embankments upon it. In some cases aqueducts are built, of which we shall treat separately.

For the invention of canals we scarcely know to whom or to what age we are indebted, such is their antiquity. The most ancient vestiges seem to exist in Egypt, where a canal was once undertaken to connect the Red Sea with the Mediterranean. Other canals of antiquity still remain; for instance the Yussuff Canal, and others in Persia and Afghanistan, where they had reached great perfection, and where canals had been constructed under ground for miles in length. We also find ancient canals on the Tigris and Euphrates. The Greeks and Romans did very little in the construction of canals. Charlemagne was the first to plan the connexion of the Danube with the Rhine, which work was commenced under him, but completed only in modern times. Within the last three hundred years canals have been constructed in all civilized countries, the Dutch, English, and French leading the way in improvements in the system of construction.

Excavation is the simplest and cheapest method of forming canals, and is resorted to wherever existing conditions make it possible; but few cases occur where any great length is obtained without embankments, which become necessary when a shallow stream is formed into a canal, and when a canal is carried along the side of a hill or across low or marshy land.

Embankments are mostly formed of rammed clay, and when they attain a considerable height the outside slope at least is protected from washing and caving by a stone wall of dry masonry. In cases of great height both slopes of the embankment are formed of stone walls, while the space between

them is filled with clay, which is wetted and worked into a mass of the consistency of potter's clay, and well rammed down, an operation termed *puddling*.

The two sides or banks of the water-way are sloped; in hard and clay soils the slope need not exceed 1½ base to 1 rise; but in softer soils a greater slope must be given, and in loose soil the banks must be well protected by fascines, piles, or stone walls, from the washing caused by the fluctuation of the water attending the passage of the boats. The depth and width of the canal depend of course on the size and capacity of the boats intended to be put upon it. The width at bottom should be sufficient to permit the passage of two boats abreast without their rubbing against the side slopes.

If a canal is to be navigated by steam, both the slope of the banks and the depth should be increased, and the protection of the banks made more permanent, as the washing caused by the wheels and the rapid passage of the boats is very great. Most canals, however, are navigated by means of horses or mules, for which purpose the top of one bank is formed into a road called the *tow-path*, which continues uninterruptedly, occasionally changing sides by means of bridges. The surface of the tow-path is formed either of hard sandy clay or of small broken stones; it should be from eight to twelve feet wide, to admit readily of the passage of two horses and riders abreast, and should have a lateral slope from the canal to shed off the rain-water. At suitable intervals drains are constructed to carry off the water either into the canal or away from it, as opportunity may serve.

It is seldom practicable to continue a line of canal on the same level for a great distance. The points to be joined by the canal are frequently on different levels, and hills or valleys intervene on the route, which it is impossible or too expensive to cross on the same level by means of excavation or embankment. In such cases successive portions of the canal are built on different levels, the boats passing from one level or *reach* into the other by means of *locks*, of which we shall treat fully below.

A longitudinal slope should be given to the bottom of the canal sufficient to cause a moderate current of water, not exceeding three feet per second. If the current is too slow the water is liable to become stagnant in places, and to accumulate mire and rubbish to a great degree; if too fast, the expenditure of water and the resistance to the boat is too great. In long reaches and on hill sides, openings are left at intervals in one of the banks, in which dams are built even with the water-line of the canal, for the purpose of discharging the surplus water occasioned by rains and lockage. These dams are called *waste weirs*, and are constructed either of wood or stone; they retain the water at the required height, but allow it to flow over in case of a rise. They are also provided with draw gates to act as drains for the purpose of carrying off mire and rubbish, and of emptying a reach in the canal when necessary for repairs.

Among the most important canals in the world is that of Languedoc, in France, which connects the Mediterranean Sea with the Atlantic Ocean, and thus avoids the dangerous passage of the Straits of Gibraltar. It was

projected in the year 1660 by François Andreossy, and commenced in 1666 by Peter Paul Riquet, on the upper Garonne.

This canal runs across the isthmus which connects the peninsula of Spain with France, and which is inclosed between the Pyrenees and the mountains of the Rhone. It commences in the river Garonne, on the west side of the city of Toulouse, and after rising through eight locks reaches the river Lers, along which it ascends through thirteen locks to Villefranche. From this point, after crossing the Lers by an aqueduct, it reaches the summit level by means of five additional locks. These 26 locks make a rise of about 220 feet above the level of the Garonne, in a distance of 22 miles.

From the summit level, after crossing six streams, the canal descends through 37 locks to the river Aube; continuing northwards from the city of Trebes, it arrives at the main level near Olangac, by another descent through 22 locks, after having crossed five other streams, which have their sources in the Montagne Noire. The main level continues along the sides of the mountains, in many places with aqueducts, crosses two streams, and after considerable winding around the Ecurene mountain cuts through a ridge of the Malpas hills with a tunnel 575 feet long, which ends with a chain of eight locks. Here the canal descends to the plateau of Fonseranne, whence continuing southwards, it crosses the rivers Orbe, Libron, and Agde, and makes its final descent into the Mediterranean. In its approach to the latter it crosses a small lake, through which for about four miles it is carried between two embankments, the level of the canal being higher than that of the lake.

From the summit level to the Mediterranean the distance is about 114 miles and the descent 658 feet. The canal has in all 102 locks (one of which is circular, with 95 feet diameter, *pl.* 10, *fig.* 18), 55 aqueducts, numerous dams and dykes, one tunnel, and 92 bridges, in a distance of about 136 miles. The lift of the locks is from five to twelve feet. The width of the canal is generally 36 feet at bottom and 68 feet at the waterline; the depth is seven feet. The boats used upon it are 90 feet long, from 18 to 20 feet wide, draw 5 feet 6 inches of water, and carry 100 tons. The first trip was made in June, 1681.

For the supply of water at the summit level feeders were constructed, which deserve some attention. Eight small streams of the Black Mountain (*Montagne Noire*) were brought together by means of ditches and excavations in the rocks into one channel, which was blasted out of the rock for a distance of five miles along the mountain, and then carried through it by a tunnel 420 feet long and 9½ feet wide. At this point it is joined by another feeder, the two forming a larger one, which, continuing its course along the mountains, enters the great reservoir of St. Ferreol. From here it takes the direction to the river Gorge, and entering the basin of this river, the combined waters are carried by the great feeder to the reservoir of the summit level which supplies the whole chain of locks. The whole length of these feeders is about 37 miles, although in a direct line the distance is not over 16 miles.

The most important structure on this canal is undoubtedly the great

reservoir of St. Ferreol, of which *pl.* 11, *fig.* 1, is a section, and *fig.* 2 a part of the ground plan. The inner or principal wall of this reservoir is 110 feet high, and contains about sixteen hundred thousand cubic feet of masonry. To about 40 feet from the bottom this wall is 40 feet in thickness; then suddenly contracting to 18 feet, it tapers to the top, where it is about six feet thick. At a distance of 200 feet from the inner wall, the outer wall is built 64 feet high, and the space between the two walls is filled with binding clay, which is well rammed. Through an arched aqueduct which commences about the middle of the reservoir (D, *figs.* 1 and 2) the water is let into the feeder-canal through guard-gates, at a rate insuring safety to the works. The reservoir is 530 feet long and 265 feet wide.

Another important reservoir of this canal is that at Lampy: *pl.* 11, *fig.* 3, represents a side elevation of it; *fig.* 4, a section through A, and *fig.* 5, a section through B. The water can be let off at different heights, as seen at A and B.

C. Locks.

A lock is a small basin which connects different levels of a canal, and through which boats ascend or descend from one level to the other. The bottom of the lock is even with that of the lower level, and the top is even with that of the upper level of the canal. Both ends are closed by gates provided with valves, through which the water can be let into the lock from the upper level, or lowered to the height of the lower level, the lock forming thus at pleasure a continuation of either portion of the canal. When a boat is to descend through the lock, the water is let in from above, the upper gates are opened, and the boat is drawn into the lock; the upper gates are then closed, and the valve in the lower gate is opened, when the boat will descend with the water to the lower level, and on the lower gates being opened it can continue its course. The inverse operation will be pursued when the boat is to ascend to the higher level.

From this it is apparent that locks form the most important feature in the construction of a canal. By means of them navigation is made practicable and easy where otherwise it would be impossible. Their use is not confined to canals proper, but they are also used where shallow streams have been made navigable by means of damming up successive portions, as mentioned in the introduction to this subject.

The construction of locks demands the greatest attention on the part of the engineer, as the pressure which they sustain and the action of the water upon them are greater than at any other point in the canal. The size and proportions of a lock are dependent upon the size of the boats to be used, the frequency of navigation, and the supply of water. The form is usually rectangular, unless a special object dictates a different form; *pl.* 11, *fig.* 12, is a top view of a lock, which stands by the side of a wooden dam in one of the canals in Russia; *figs.* 13 and 14 are the two side views, and *fig.* 15 a section. *Pl.* 10, *figs.* 6, 18, and 21, give the top views of different locks in the Languedoc Canal in France; *figs.* 2 and 4 show cross-sections, and *figs.* 19 and 20 longitudinal sections of various other locks, and *fig.* 29 is a

perspective view of a chain of locks on the Rideau Canal, near Bytown in Canada.

A lock consists of three divisions, viz. the upper entrance, called the *head-bay;* the middle, called the *chamber;* and the lower entrance, called the *tail-bay.* The difference in elevation between the bottom of the head-bay and the top of the tail-bay is called the *lift,* which varies according to circumstances from 5 to 15 feet. The highest single lift is in a lock at Bouzingen, near Ypern, in the Netherlands, amounting to 22 feet. The chamber is the narrowest part of the canal; it is made just large enough to admit of an easy entrance of the boat, and to leave some space for play during the commotion of the water while being lifted. It is formed by two solid walls of cut masonry, slightly battered towards the top; or if of wood the walls are built of heavy beams and planks fitted water-tight. Any excess in the size of the chamber above that required for the easy passage of the boat would only occasion loss of water and time. The head-bay as well as the tail-bay, being continuations of the main water-way, have of course the general depth of the canal; their form is usually that which we give in *pl.* 10, *figs.* 1, 3 *a*, and 3 *b*. The side-walls of the bays are called *wing-walls,* which are also battered, the batter or slope increasing from that of the chamber to that of the bank of the canal, where the wing-wall joins it.

The *lock gates* are large and heavy gates consisting of two parts or *leaves*, each leaf turning upon its own hinges, and the two abutting against each other in the middle of the water-way, where they form an angle projecting against the head of water. There are always two gates to a lock, one at each end. They are usually made of wood, but latterly cast iron gates have come into use and are greatly preferred. Those made of wood are carefully put together of heavy timber; the frame is usually composed of two upright and from four to eight horizontal pieces, which vary in thickness and depth according to the size of the gate and the head of water; these are mortised together, and covered on the side next to the head of water with durable two-inch planks, which are rabbet-jointed and caulked. The upright posts upon which the gate hinges are called *heel-posts* or *quoins;* and the other uprights forming the edges of the two leaves of the gate are called the *mitre posts.* *Pl.* 10, *figs.* 22 and 23 *a*, are representations of different lock gates. Single leaves are also seen at A and B in *fig.* 20. The heel-post (*fig.* 26) is made to turn upon an iron gudgeon which fits into an iron plate below (*figs.* 24 and 25); it is kept in its vertical position by means of two iron collars, which are fastened into the wall of the lock, and in which it turns. The mitre-posts are so bevelled that when the gate is closed they abut against each other along the whole edge, and form a water-tight seam. The bottom of the gate is also bevelled and fits closely against the *mitre sill,* which forms the head of the head-wall and tail-wall running across each end of the chamber (*a* and *b*, *fig.* 21). The water by its pressure produces a close contact of the bevelled faces, and is thus prevented from leaking through.

The gates are opened in various ways: when they are very large, a chain

attached to the mitre-post is wound upon a drum by means of cranks and cog-wheels, and the gate thus drawn into its open position. At each end and upon each side of the chamber a recess is left in the wall for the reception of the gate when opened (*pl.* 10, *fig.* 21), allowing it to form an uninterrupted line with the wall, leaving no projection against which the boat may strike in passing. The most common method of opening the gate is by means of a heavy beam, termed the *balance beam*, because it assists in balancing the weight of the leaf upon the gudgeon and keeping the quoin in an unstrained position. A lock-gate with a balance beam is represented in *pl.* 10, *fig.* 2. The balance beam is mortised upon the mitre-post and quoin, and extends some distance out upon the bank; in many cases an additional weight is put upon the end of the beam when it is not sufficiently heavy. When the gate is to be opened it is backed through the water into the recess by a steady push against the end of the balance-beam.

A lock-gate of a different construction from that above described is represented on *pl.* 10, *figs.* 3 *b* and 4. The gate here consists of a single leaf, *a*, and instead of turning on a pivot, it slides into a lateral recess, being moved by means of the windlass *d*, and ropes which pass over the pulleys *b* and *c*. This method of construction is not to be recommended, and is rarely met with.

Pl. 10, *fig.* 5, shows a kind of drop-gate, which may be used in small canals; on the left is a side view with open gates, on the right a front view with closed gates; the drop-gate may describe a quadrant, and be opened and closed without trouble. These doors have not been found very practicable.

The *valves* through which the water enters and leaves the chamber are small doors, made either in the side of the chamber-wall, the top of the end-walls, or in the lock-gate. In the former case a conduit must be built by the side of the lock for the discharge of the water, as seen in *pl.* 10, *figs.* 27 and 28. It is usual to have the valves in the gates. They must be so constructed as to be readily opened and closed, and to be water-tight when closed. Those generally employed are either *slide-valves* or *paddle-valves*. The slide-valves may move vertically or horizontally; the vertical slide-valve is the simplest in its arrangement, and is therefore most frequently used. It moves in grooves, and is opened and closed by means of a rod which passes up to the top of the gate, and is raised or lowered by a screw, or a rack and pinion. *Pl.* 10, *fig.* 22, shows a vertical slide-valve in the gate, and *fig.* 28 a similar one in the side wall of the chamber. The horizontal slide-valve is moved in a similar manner, but slides horizontally, which may be effected by means of a rack on the side of the valve, driven by a pinion on a vertical axis projecting above the water, and turned by a crank. The paddle-valve is one which turns about its middle, or at one side on a vertical axis which reaches up to the top of the gate, and is turned by means of a crank. The paddle-valve is neither as safe nor as easily worked as the slide-valve. The size of the valves is dependent upon the quantity of water to be discharged in a given time, and upon the head of water; they vary from 20 inches to four feet square, and are generally made of cast-iron.

We have thus far confined our remarks to locks of a single water-way which pass only one boat at a time. Where navigation is frequent, double locks are built, consisting of two separate chambers side by side, by which arrangement two boats can be locked through at the same time, either in the same or in the opposite directions. Double locks of the best and most durable construction have been built on the Erie Canal in the State of New York.

D. Aqueducts.

When a canal meets in its course with a river or ravine, it must be carried across on a bridge, which differs from ordinary bridges only in the superstructure, which embraces the canal and tow-path. As a specimen of a stone aqueduct, we give on *pl.* 11, *figs.* 6, 7, and 8, a side-view, cross-section, and top-view of the Cesse Aqueduct, designed by Vauban for the Languedoc Canal. The water-way is frequently carried across the bridges in wooden trunks; of this there are many examples in the United States, where wooden aqueducts have been more extensively constructed than elsewhere.

The first aqueduct of cast-iron was the Chirk Aqueduct on the Ellesmere Canal, built in 1795, by Thomas Telford, who, encouraged by its success, constructed immediately afterwards, on the same canal, the Dee Aqueduct, in the valley of Llangollyn, 127 feet above the bed of the Dee, and 1000 feet in length. It consists of 19 arches of cast-iron, abutting on stone piers (*pl.* 10, *fig.* 10). Each arch consists of four ribs, as shown in the cross-section (*fig.* 11), secured against lateral motion by connecting-plates (*fig.* 13). An abutting plate or skew-back is shown in *fig.* 12. The bottom plates (*fig.* 14), as well as the side-plates, are firmly connected by flanges, and are made water-tight by iron cement. The position of the tow-path is seen in *fig.* 11. The canal is 12 feet wide.

The carrying of canals across rivers is not the only object of aqueducts. They have been built since the remotest times for the purpose of conveying water into cities. The Egyptians, Greeks, and Romans had large structures of that kind, and they continue to be built in modern times. The Croton Aqueduct, by which the city of New York is supplied with water, completed in 1842, under the direction of J. B. Jervis, is the most gigantic modern work of the kind, of which we will here give a description.

It was constructed at the expense of the city of New York, and cost about twelve millions of dollars. The conduit commences at the Croton river, in Westchester county, where a dam has been constructed which raises the water of that stream 40 feet above its natural level, and 116 feet above mean tide, setting back the water of the river about 5 miles, and forming a reservoir of about 400 acres surface. The aqueduct runs down the valley of the Croton to the shore of the Hudson, which it leaves again at the village of Yonkers, and, crossing the valley of the Sawmill river and Tibbitt's Brook, gains the summit between the Hudson and East Rivers, and continues on it to the Harlem River, a distance of 33 miles of continuous masonry. Iron pipes are then laid 1450 feet on an arched bridge

across the valley of the Harlem River, after which the aqueduct of masonry is resumed, and continues two miles to the Manhattan valley, which is passed with four iron pipes, descending 102 feet to the bottom of the valley, and rising again to its opposite side, forming a syphon of 4100 feet in length. The masonry conduit is again resumed, and crossing the Asylum ridge and Clendenning valley, is continued two miles to the receiving reservoir at Yorkville, whence iron pipes laid beneath the surface of the ground conduct the water a distance of two miles to the distributing reservoir at Murray Hill, three miles from the City Hall.

The length of the aqueduct from the Crotom dam to the receiving reservoir is $45\frac{1}{2}$ miles. Its general declivity is $13\frac{1}{4}$ inches to the mile. The form of the masonry conduit is seen in *pl.* 11, *fig.* 11; the bottom is an inverted arch, the chord of which is 6 feet 9 inches, and the versed sine 9 inches; the side-walls rise 4 feet from the springing line of the bottom arch, with a batter of 1 inch to a foot rise, making the width at the top of the side-walls 7 feet 5 inches. The roof-arch is a semicircle, making the area of the interior 53.59 feet. The supply of water furnished daily is about fifty millions of gallons, which is more than the aggregate of all the London water-works, and more by ten millions of gallons than the quantity furnished by the fourteen aqueducts which supplied Rome in the days of her greatest splendor.

There are on the line sixteen tunnels, driven chiefly through gneiss and marble, the aggregate length of which is 6841 feet. The streams encountered are crossed by 114 culverts with spans from 12 to 25 feet, at depths varying from 12 to 70 feet below the grade. There are also five road crossings of from 14 to 20 feet span. The aqueduct is covered with earth to a sufficient depth to protect the water from frost. There are thirty-three ventilators placed at a distance of one mile from each other, to give free circulation of air through the aqueduct; they rise 14 feet above the surface of the ground, and have a circular aperture of 15 inches diameter; eleven of them are provided with doors by which the aqueduct may be entered. There are also six waste-weirs to allow the water to run off when it reaches a certain height, and to allow the aqueduct to be emptied should it become necessary. They are constructed of well dressed stone, with cast-iron gates and frames.

The Croton reservoir, which has received the name of Croton Lake, is available for 500 millions of gallons above the level that would allow the aqueduct to discharge thirty-five millions per day. The greatest height of the weir of the dam above the bed of the river is 55 feet. The width of masonry at low-water line of the river is 61 feet; the form on the lower face is a curve described by a radius of 55 feet, which continues to within 10 feet of the top, when a reversed curve of 10 feet radius carries the face over to meet the back line of the wall. The back line is carried up vertically with occasional projections. The waste-weir is 270 feet in width. At 300 feet below the main dam is a second dam 9 feet high, which sets the water back over the apron of the main dam, and thus forms a pool to check the water as it falls over the weir. The gateway which guards the entrance to the

aqueduct is placed on a solid gneiss rock, through which the aqueduct passes by a tunnel of 108 feet in length. The gate chamber is provided with a double set of gates, one set of guard-gates of iron, the other a set of regulating gates made of gun metal. The gates are all 18 by 40 inches, and there are nine in each set; they are operated by means of wrought iron screw rods.

The Harlem bridge is represented on *pl.* 11, *fig.* 9; it crosses the valley of the Harlem river with eight arches of 80 feet span, and seven of 50 feet span; they are semicircular, and the height to the top of the parapets is 114 feet above ordinary high water; the width on top of the parapets is 21 feet. The material of the bridge is dressed granite. The water is conveyed across the bridge in three iron pipes of 3 feet diameter, having an extra fall of 2 feet in order to make their capacity for conveying water equal to that of the aqueduct.

The greatest depression of the Clendenning valley is 50 feet below the top of the aqueduct, and the valley is 1,900 feet across. Streets cross the line of the aqueduct in this valley at right angles, and archways are constructed over them. *Pl.* 11, *fig.* 10, represents the aqueduct, and *fig.* 11 is a section of the same.

The receiving reservoir is 1,826 feet long and 836 wide, and covers with its embankments an area of thirty-five acres. It is divided into two parts, having respectively the depths of 20 and 30 feet; its present capacity is 150 millions of gallons. It is formed by earth-banks, the interior having regular rubble walls; the outside is protected by a stone wall on a slope of one horizontal to three vertical, the face laid in cement mortar, and the inside dry.

The distributing reservoir at Murray hill is 420 feet square, and covers four acres; it is 36 feet deep, and holds twenty millions of gallons. The walls are of hydraulic stone masonry, constructed with openings made by an interior and exterior wall, connected every 10 feet by cross walls, in order to give an enlarged base and reduce the quantity of masonry. At 17 feet from the top the cross-walls are connected by brick arches; the exterior wall, 4 feet thick, is then carried up single to the top, where it has an Egyptian cornice surmounted by an iron railing. On each corner of the reservoir pilasters 40 feet in width are raised, projecting 4 feet from the main wall, and in the centre of the street-façades are pilasters 60 feet wide; they have doors and stairways leading to the top of the walls and to the pipe chambers, in which the supply of water can be regulated by stop-cocks. The reservoir is divided by a wall of hydraulic masonry into two divisions, from both of which the city is supplied, and in each there is a waste-cock to draw the water from the bottom. The level of the reservoir is 45 feet above that of the adjoining streets, and higher than any part of the city of New York.

E. Canal Bridges.

On canals which are not navigated by vessels carrying masts, the foot and road bridges crossing them are built like other structures of the kind; care should be taken to give them sufficient height to allow persons

to stand upright on the deck of boats passing under them. When on the contrary sailing vessels are used on a canal, drawbridges of various kinds are constructed, which may be opened to allow the passage of the boats. The common drawbridge is raised vertically on hinges, by means of a windlass or other machinery. *Rolling bridges* are those which are drawn back horizontally on rollers, and *turning bridges* move aside by revolving on a vertical axis or hinge. *Pl.* 10, *fig.* 7, is a side view of an iron turning bridge of 40 feet span; *fig.* 8 is a top view of one wing with the roadway partially removed; *fig.* 9 is one of the inner ribs or semi-arches which support the roadway. Both wings turn about an axis at *c*, *c*, and when they meet they are rounded off in such a manner as to slide past each other when turned. This bridge is preferable to a drawbridge, being more readily moved and more durable.

II. WINDLASSES AND CRANES.

Of the great variety of machines which have been invented to facilitate the labor of raising weights which manual labor alone could never move, we propose to describe and illustrate only the most important and interesting.

WINDLASSES and JACKS are simple machines designed for raising heavy weights. The simplest forms of these are too well known to require illustration. A windlass of more elaborate construction is represented on *pl.* 12, where *fig.* 10 is an end view, *fig.* 11 a front view, and *fig.* 12 the bottom frame. The wooden drum *a* is mounted on an iron axle, which also carries the spur-wheel *b*, which is driven by the pinion *c*, the axle of which is turned by the two winches *d d′*; the frame B rests on the rollers *f f*, which may be made to run on a railway. The windlass is used in building and in manufactories, where heavy loads require to be moved from one place to another. In France they are employed, as shown in *fig.* 10, to lift the bodies of mail coaches, D, off the ordinary wheels, E, and place them upon the railroad trucks, C. The ropes or chains pass down over the pulleys, *q q*.

CRANES have a two-fold motion; that by which the load is raised, and a rotary motion by means of which it may be deposited in another place. The frame of a crane consists of a post or upright beam, from the upper end of which projects horizontally or obliquely upwards a beam called the jib, at the end of which the load is raised, and which is supported by a brace or stay. The post turns on pivots at both ends, or sometimes on the lower end only. At the end of the jib is a pulley, over which, in cranes of a simple construction, passes a rope from the load to a drum which is turned by winches, or, when heavy loads are to be raised, by a spur-wheel and pinion, as in the machine last described. Cranes are generally erected on wharves for the unloading of vessels, and they are universally employed in foundries and machine shops, where enormous loads are lifted and moved by means of them.

Pl. 12, *fig.* 6, is a side view of a crane generally used in foundries; *fig.* 7 is a top view of the same. It is entirely of iron; the frame consists of two plates separated by cross-pieces, and held together by screw-bolts, *h h*; B is the post, C the stay, D the jib; the gudgeons, *p p′*, of the post turn on friction rollers, as shown in *fig.* 8. The force is applied at the winches, O, on the axle of the pinion, N, which drives the spur-wheel, M, on the axle of which is another pinion driving the spur-wheel, K, which carries round the drum, L. On the axle of the pinion N is a ratchet-wheel, into which a catch or detent falls to prevent the load from descending when the power ceases to act. The chain passes from the drum over the pulleys, Q and H, to the load. Besides the circular motion about the gudgeons, a rectilinear motion towards or from the centre can be given to the load in this crane by means of the following construction. The pulley, H, is attached to a small truck, G, which can be drawn along the track, T, by means of the rack F; the latter is driven by the pinion, P, which is turned by means of the rope, *n n*, wound several times around the drum, J, on the axle of P.

Another crane, of French construction, composed of wood and cast iron, and intended for raising very heavy loads, is represented on *pl.* 12, *fig.* 1, being a view from behind, and *fig.* 2 a side view; *fig.* 3 shows the arrangement of the wheels on a larger scale. It is supported entirely at the lower end on the axis A, which is a hollow cast iron cone (a section being partly shown in *fig.* 2) turning on a gudgeon, B, at the lower end, and at the top in an iron collar, C, which are fastened in a pier of solid masonry. The jib, E, and stay, F, are of wood; the drum, Q, on which the chain, *r*, is wound, and the wheelwork arms, G G, attached to the posts are of iron. The operation of the machinery is readily understood from the figure. In order to sustain the load when raised, and to allow it to descend slowly when desired, a small drum, *n*, is attached to the spur-wheel, J, having a ratchet-wheel and brake, as shown on a larger scale in *figs.* 4 and 5.

Pl. 12, *fig.* 9, is a drawing of a very ingenious crane in the machine-shop of Maudslay, in London, which is mounted on wheels in a room used for setting up large engines, and which serves for raising and transporting the heavier parts of the engines, and for adjusting them in their positions. It has two arms, Q Q, which are movable about the bolts, *a a*, and may be raised or lowered by means of the chains attached at *b b* and wound around the drum, A, when it is desired to bring the load nearer to or further from the centre of the crane. The drum, A, turns with the cog-wheel, B, which is driven by an endless screw on the spindle, E, which also carries the wheel, D; the latter is driven by the pinion, F, when the spoke-wheel, G, is turned by hand. The load is raised at one arm only, while at the other a counterpoise is suspended, which descends as the load is raised, and vice versa, and serves to establish the equilibrium of the crane. The chains by which the load and counterpoise are suspended are attached to the arms at *c c*, and passing over the pulleys, H and J, are wound over the drum, K, the axle of which rests in bearings at *d*, which are set into the post, T. The force is applied at the crank, O, and turns the drum by means of the pinions, *e* and M, and the spur-wheels, N and L; if lighter weights are to be raised

the crank is applied at f to the axle of the pinions, M, and e is thrown out of gear by releasing the detent, g. The frame, P, turns on a centre pin, i, and is supported on six rollers, h, which run in a circular track on the truck, R. The latter is mounted on four wheels, t, which can be set in any direction by means of bolts, k. When the whole crane is to be moved, it is done by means of blocks and tackle, as the application of levers under the truck would disturb the equilibrium of the machine.

III. HYDRAULIC MACHINES.

Hydraulic machines, by the aid of which water is raised or thrown from a lower to a higher point, are very various in their character and construction, and will be considered under their appropriate subdivisions.

1. Pumps.

We have in general three classes of pumps, viz. *suction* or *lift pumps*, *forcing pumps*, and *double action pumps*, which combine the principles of the two former.

A *lift-pump* (*pl.* 13, *fig.* 1) consists of a straight or bent pipe AB, the *suction-pipe*, extending below the surface *cd* of the water, enlarged at the lower end, and generally provided with a strainer or perforated cap, *ab*, to exclude impurities; joined to the upper end of the suction-pipe is a pipe CD, which is generally larger than the former, and must be bored truly cylindrical, in order to allow the box G to fit perfectly water-tight and move with as little friction as possible. At the junction of the two pipes is placed the valve A, the *suction-valve*, which in its simplest form moves on a leather hinge, opening upwards. The box G is perforated and provided with a similar valve F, also opening upwards. HJK is the pitman, which is moved up and down by means of the bent lever or pump-handle KLM. Frequently there is a contrivance to insure the rectilinear motion of the piston-rod, or at least there is a joint at J, which allows the portion JH to remain nearly perpendicular during the reciprocating motion. The action of this machine is quite simple: at the commencement the suction-pipe is filled with water to *ei* (the level of the surrounding water), and the space between *ei* and the bucket G is filled with atmospheric air. As the bucket rises the air between it and the suction-valve A will expand, and the latter will be opened by the greater pressure from below; when the bucket has reached its highest position, *kl*, the water will have risen to a height, *mn*, at which its pressure added to that of the rarefied air in the space *klmn* equals that of the exterior air; the suction-valve will now be closed by its own weight. By the descent of the bucket the air between it and the valve A is condensed again until its pressure begins to exceed that of the exterior air, when the bucket-valve F will open and allow the air to escape. By repeating the

motion the water will be caused to rise successively in the suction-pipe, and will reach the valve A, open it, and arrive at the bucket. In descending through the water the bucket-valve will be opened, and the water will ascend through it, while the pressure will keep the suction-valve closed: on rising, the bucket-valve will close, the bucket lifting up the water in its ascent, while the pressure of the atmospheric air will force the water in the suction-pipe to follow the bucket to its highest position. By the continued play of the bucket the water will thus finally be raised to a reservoir, EE, at the top of the pump, whence it is discharged by spouts or cocks.

In this pump the water is raised entirely by the ascent of the bucket and the pressure of the atmospheric air. When the height, *qe*, of the bucket in its lowest position above the level of the water, *cd*, exceeds that of a column of water the pressure of which equals that of the atmosphere, then the water will not follow the bucket in its ascent, and cannot, therefore, be raised above it. The greatest height at which the bucket may therefore be placed above the level of the water to be raised is 32 feet, the height of the above column. In practice this height will be diminished by 2 or 3 feet, as the development of air contained in the water and the want of a perfectly air-tight fit of the piston will not allow a perfect vacuum to be formed.

A *forcing pump* in its simplest form is represented in *fig.* 2. The cylinder AB, immersed in the water, is closed at the bottom by the valve *f*, and communicates by the valve D with the pipe DE, through which the water is forced to the required height. The solid piston or *plunger*, C, has no valve, and is here moved by means of a lever of the second kind. When the plunger rises, the water will ascend into the cylinder by its own pressure and that of the air; as the plunger begins to descend, the pressure will close the valve *f* and open D, through which the water will be forced into the pipe DE. As the plunger ascends again the valve D will be closed by the pressure of the water in DE, which is thus prevented from returning into the cylinder. If the plunger in its highest position is below the surface of the exterior water, the pump will act independent of the pressure of the air, and is then a forcing-pump, properly so called.

A *double action pump* is one in which the cylinder is elevated above the level of the water, communicating with it by a suction pipe. This is a kind of pump very frequently employed to raise water to great elevations. A simple lift-pump, however, may also be employed to raise water to a considerable height.

As an example of this kind *fig.* 3 represents Stephenson's pump for wells. A is the surface of the ground; BB the wall of the well in which the water-level is below C. D is the pump-handle by which the pitman *a* is worked: the latter consists of wooden rods, joined together by iron fastenings, as shown in *fig.* 6. All the pipes are of wood; the cylinder E has a brass lining, intended to diminish the friction of the bucket *d*; *f′* is the suction-valve. The upper end of the cylinder is closed by a metal cover, *g* (*figs.* 4 and 5), which has a stuffing-box in the centre for the iron piston-rod, *h*; *k* (*fig.* 3) is a guide which keeps the piston-rod in a vertical position. The lift-pipe F consists of as many pieces as are required to carry the water

to the desired elevation: the conical joints of the pieces are seen in the figure. It would be preferable to have a valve at the inclined junction-pipe *e*, in order to relieve the valve *f′* from the pressure of the water in F. The water is discharged at the spout *i*. N is a second spout provided with a screw, on which a hose may be screwed to convey the water to a distant point.

Pl. 13, *fig.* 7, represents a pump of superior construction in the mine Huelgoat, in Normandy. The plunger P in its upward motion lifts the water through S T′, and L, and the lift-valve S′ into the lift-pipe B; during its downward motion the water is forced up from the reservoir B′, through the suction-pipe A, by the pressure of the air, raising the valve S. The cylinder C is of bronze, open below, and provided at the top with a stuffing-box for the piston-rod X. The packing of the plunger P is shown in *figs.* 8 and 9, consisting of a leather ring pressed outwards by the eight sectors, *l*, and the springs, *l′*. The valve-box consists of the two portions L and L′, the upper one of which is fitted to the lift-pipe at *vv′* and has a vent at *r′*; and the lower one connects with the cylinder by the pipe T, and has a vent at *r*. The valves *s* and *s′* are conical or *puppet valves*.

When the pump is to be put in operation the lift-pipe is brought into communication with the suction-pipe by opening the cocks *u u′ u″* of the bent tube D, and water is poured into the pump, the valves Z Z′ at the bottom of the suction-pipe preventing its escape. The confined air is allowed to escape by the vent W, the cocks *u u′ u″* are closed, and the pump is ready for action.

A pump by Letestu of Paris, which differs from those heretofore described in the construction of the valves and piston, is represented in *figs.* 10, 11, and 12. The latter shows the construction of the suction-valve, which consists of the disk, G, perforated by a great many holes, and covered by a leather disk, *a*, which is fastened by the screw, *b*. During the ascent of the bucket the leather disk is raised up by the pressure of the water admitting it into the cylinder, while during the downward stroke it is pressed firmly upon the disk, G, closing the openings. The bucket (*fig.* 11) consists of a perforated funnel with a loose conical leather-cap, *d*, which in the upward stroke is pressed against the sides of the funnel and of the cylinder, and thus makes a perfect packing. The lift-valve, J, is of the same construction as G, and the packing of the piston-rod, D, is also effected by a leather funnel, *e*.

2. The Hydraulic Ram.

The *hydraulic ram* is a machine designed to make use of water-power when with a considerable elevation or *head* of water the supply is so small as not to suffice for the turning of wheels. The mechanical effect is produced by the pressure of a high column of water confined in a pipe upon a piston, and the momentum it accumulates in descending a certain distance. The essential parts of the machine are, besides the main-pipe, a cylinder with the driving piston, and an arrangement of self-acting alternating valves.

by means of which a reciprocating motion is given to the piston. This machine is generally employed for the purpose of raising water, the driving piston being connected with the plunger of a pump. The construction and play of it are best illustrated by reference to *pl.* 13, *fig.* 15, which represents a section of a machine of this kind constructed by Reichenbach in the salt-works at Illfang in Bavaria, which forces the saline water to an elevation of 1,218 feet. *Figs.* 16, 17, 18, 19, 20, and 21, represent details of the same.

The column of water which acts as the motive power enters by the main-pipe, A (*fig.* 15), the supply being regulated by the throttle-valve, *a*, and after having performed its work it is discharged by the pipe, N. The whole mechanism is in the four verticals, A′, C′, F′, O′; in A′ is the pipe B branching off from the main-pipe, and communicating with the horizontal pipe, B′, when the stop-cock, *b*, is opened. In the vertical C′ is the pipe, C, which is seen on a larger scale in *fig.* 21; it communicates with the pipes, B′, and contains two small pistons, *d* and *d′*, both on the same rod, D, and drawn in *fig.* 15 in their lowest position. In the vertical, F′, is the distributing box, consisting of two cylinders, F and G H, the lower one having a larger diameter; in the former moves the piston K, in the latter the pistons, L and M, all fixed in the same vertical axis. In the vertical, O′, are the three cylinders, P, Q, and R, the first of which contains the counter-piston, S, the second the main driving piston, T, and the third the plunger, U, which forces the saline water to the required elevation. The cylinders P and R have equal diameters, and are both open at top, while Q is open at the bottom. The cylinder, R, of the forcing pump, the suction pipe, X, the chamber for the puppet valves, *x* and *x′*, and the pipe, Y, are supported by a strong wall.

We will now suppose all the parts of the mechanism to be in the positions represented in *fig.* 15; the stop-cock *a′* is closed, *b* is open, and there is no air in any of the pipes. The water from the main-pipe fills the cylinders, G, F, P, and the pipes, B, B′, Q′, and P′. The small pistons, *d* and *d′*, are at rest, having equal diameters and suffering equal upward and downward pressures. The pressure on the unequal pistons, K and L, is greatest in the downward direction, but their descent is prevented by the rod, *m*. The water therefore passes through Q′ to the main piston, T, which is driven downwards by a pressure equal to the weight of a column of water having the diameter of the piston, T, and the height of the main pipe. In its descent, T carries with it the counter-piston, S, and the plunger, U; the action of the latter is to force the saline water into the conduit pipe, Y, while the former expels the water contained in P through the spout, *j*. As the main piston arrives at its lowest point, a small pin, *e′*, on the rod *t* (*figs.* 15 and 19), pushes down the end, E′, of the lever, E′E, and thereby raises the opposite end, E, and the rod, D, with the piston, *d* and *d′*. The water will now enter below the piston, M, through *c*, and will neutralize the pressure from above upon L; the pressure upon K will therefore carry all three alternating pistons rapidly upwards, cutting off the communication of Q′ with A, and establishing that between A and P′, which will immediately produce an ascent of the counter-piston, S, and consequently of T and U, the water in Q passing through Q′ and I into the discharge pipe, N. When T reaches again its highest position

the pin *e* will push the lever, E', E, into its former position, carrying with it the pistons *d* and *d'*, and cutting off the communication of the water below M with the main pipe. The downward pressure on L exceeding the upward pressure on K, they will descend again to the position of *fig.* 15, the water below M being expelled though *c*, C, and *c'*, into N, when everything is again in the position first assumed.

The two small cut-off pistons, *d* and *d'*, are of block tin. The alternating pistons, K, L, and M, consist each of brass cylinders with a ring of block tin, which, being soft and elastic, serves as packing. The counter-piston, S, has the same construction. The main piston, T (*figs.* 15, 18, and 19), consists of a cylindrical piece of brass (shaded in *fig.* 19) encircled by two rings, *s*, *s*, of block tin, which are sufficiently elastic to expand a little when a pressure is exerted from within, and to contract again when the pressure ceases. This property is made use of by means of the small tubes, Z', Z', which communicate with circular grooves in the brass body under the middle of the rings. During the descent of the piston the water entering the grooves will press the rings outwards and produce a perfect packing, while during the ascent the pressure is in a great measure relieved, allowing the wings to contract and experience very little friction. The plunger, U, consists of disks of leather saturated with oil; the manner of putting them together is seen in *fig.* 19. A better construction is shown in *fig.* 20, where it consists of two different layers of leather disks, the upper set forming the plunger, and the lower set, of less diameter, receiving the blow of the piston on the plate, *y*. The piston-rod, S', has a ball and socket-joint, as is seen in *fig.* 19, which also shows the connexion of T and U. The piston-rod, *kf*, also has a ball and socket-joint at L. *Fig.* 17 represents a horizontal section along the line, 3,4, in *fig.* 15, of the forcing pump and valve chamber; *fig.* 16 a similar section along the line, 1,2, in *fig.* 15.

A second hydraulic engine of this kind is represented in *pl.* 13, *fig.* 13. It was built by Jordan in the mine of Clausthal, in the Hartz, and was completed in 1835, together with another similar one, which works in the same shaft. The main piston has a diameter of 17 inches, and is driven by the hydrostatic pressure of a column of water 688 feet in height. The operation of this machine is similar to that just described, and will be readily understood. E is the main pipe, 6 inches in diameter; O M U are the alternating pistons by which the driving-column is cut off and let on; T is the main cylinder in which the piston is driven upwards by the pressure of the water; H is the back-water pipe through which the spent water is carried off; *h* is a double stop-cock, which opens or cuts off the communication of the pipes E and H with the cylinder U, by means of the tubes L, L', and L'', which have a diameter of $\frac{7}{8}$ of an inch. The figure represents the machine just after the completion of the upward stroke; the communication of the main pipe with the cylinder T is cut off by the piston-valve M, and the main piston-rod D will descend, and by its own weight and that of the long piston-rod G, which descends to the bottom of the shaft, will force the spent water in T up the back-water pipe H to an elevation of 80 feet, where it flows off. In descending, the projection B operating against the angular arm *a'*, causes

the axle W to turn through a certain arc, which, by means of the rod *g* and the lever *z*, turns the cock *h* so as to shut off the main water from the cylinder U. The pressure upon M exceeding that upon O, will cause M to descend, and admit the water from the main into T, when the main piston will commence its upward or working stroke. As it reaches the top, the projection B will, by acting on the arm *a*, turn the cock *h*, so as to admit the main water through L into U, and to close L′; when the piston-valve M will ascend and close the communication between the main pipe and cylinder, leaving the piston to descend as before. The couplings of the pitman-rods are shown in *fig.* 14.

3. Fire-Engines.

A further application of the suction and forcing-pumps are *fire-engines*, which serve to throw water or other fire-extinguishing fluids to a considerable distance or elevation. The chief requisites of a fire-engine are, that it should be as compact and portable as is consistent with the power of furnishing a large quantity of water, and that the stream of water thrown by it should not be intermittent but continuous, and that any desired direction may be given to it. All fire-engines consist of a single or double forcing-pump, provided with an air-chamber, the effect of which is to make the discharge of water continuous. The essential features of the machine are the following: one or two cylinders, at the bottom of which is the bottom or suction-valve, opening into the cylinder; each cylinder is connected with the air-chamber by a pipe, at the junction of which with the air-chamber is a valve which admits the water into the latter, but prevents its return. In the lower part of the air-chamber is the pipe through which the water is expelled, and which consists of several portions so joined together as to allow the mouth or *branch-pipe* to be turned in every direction, or else a leather pipe or *hose* ending in a brass nozzle is screwed to the first piece. The plungers in the cylinders are moved by levers on which the firemen operate. The cylinders and air-chamber generally are mounted in a water-box, which is supplied with water from a reservoir by means of a hose; when this reservoir is below the level of the fire-engine, the water is drawn from it by suction, and the suction-hose is stiffened out by spiral coils of wire (*pl.* 14, *fig.* 20 *b*) to prevent its being compressed by the atmospheric pressure.

The operation of fire-engines differs from that of ordinary pumps only by the action of the air-chamber. At the beginning of the play of the engine the chamber contains a quantity of air corresponding to its volume; as water is forced into it while the nozzle remains closed, the air will be compressed in the chamber to a great degree, and will, on the nozzle being opened, expel the water with great velocity in a copious stream, which retains its force without much variation while the pump continues to be worked. The suction-valves are either conical, spherical, or plane-valves. The spherical or ball-valves (*pl.* 14, *fig.* 19) are the most usual, and deserve

the preference over conical valves, as they close perfectly, even when coming down a little inclined, which is not the case with the latter. Plane or hinge-valves consist of square or round plates of brass, well polished, and moving on hinges; or else a disk of leather is screwed between two plates of metal, one of which is a little smaller, the other a little larger than the opening to be closed, the leather disk thus closing the opening, while a prolongation of it serves as a hinge. The valves in the pipe connecting the cylinders and air-chamber are always hinge-valves in an oblique position.

We will now proceed to explain the construction of different kinds of fire-engines, with the aid of plate 14. *Fig.* 1 is an elevation, *fig.* 2 a section of the simplest machine of the kind, which is readily worked and carried about by one person, and, having no air-chamber, throws an intermittent stream. A is the cylinder, B the suction-valve, C the perforated suction-pipe; when the plunger, I, is raised, the water enters the cylinder through B, and in descending the plunger drives the water through the pipe, D, and the valve, F, into the hose, G, and expels it in a stream from the nozzle, H. The crutch, L, serves to manage and support the machine.

A portable fire-engine with a single cylinder, which acts far more powerfully than the above, but requires several persons for its management, is represented in *figs.* 3 and 4, the former being a cross-section in front of the air-chamber, the latter a longitudinal section. In the trough, *a*, is the sill, *b*, to which the main parts of the engine are screwed; *c* is the plunger, *d* the air-chamber, with the orifice, *f*, opening into the branch-pipe, *i k*, which is movable in every direction by means of the joints at *g*, *h*, and *i*, and the construction of which is shown in detail in *fig.* 18. The pump is worked by the lever, *n*; the levers, *p p*, which turn about the bolts, *q q*, serve for transporting the engine, when they bear against the projections, *r r*.

A double-acting portable fire-engine of very simple construction is that by Letestu, having pistons and valves on the principle explained above in speaking of his pump. *Fig.* 11 is a longitudinal section, *fig.* 12 a top view, *fig.* 13 a cross-section through the air-chamber, *fig.* 14 a horizontal section along the lower dotted line in *fig.* 11, and *fig.* 15 a front view of the engine. On a strong support, A B, provided with the rings, C, through which poles may be passed for transportation, rests the trough or water-box, D; in its centre is the air-chamber, E. The piston, K, in ascending admits water into the cylinders, H, and in descending forces it through the valve, G, into the air-chamber, whence it is expelled through the pipe, O, to which the hose and branch-pipe are screwed. At L the piston-rods are attached to the lever or balance-beam, M, which moves about the centre-bolt, P, and is worked by means of the arms, N N.

A more complex fire-engine is that by Pontifex, of London, which is frequently used on board ships, on account of its requiring but little space. *Fig.* 5 represents a longitudinal and *fig.* 6 a cross-section. It is inclosed in a box, A, which has at the bottom the projecting leaves, *e* (the one on the left hand is omitted), that fold up about a hinge, *f*; when the engine is in use they are turned down and a part of the men stand on them, giving stability to the engine. The upper part of the box consists of two pieces

which turn on the hinges, *a*, and when closed are held together by the hook, *b*, *fig.* 6. Four ring-bolts, T, are attached to the box by which it is carried, the brake-bars, M, being put through them. The working parts of the engine are now readily understood by inspection of the figure. *t* is a guide-rod which passes through a packing-box at *l'*, and insures the rectilinear motion of the plunger. Two uprights, *x x* (*fig.* 6), support the axis, R, of the balance-beam, K H K L. The pipe, *p q*, leads from the air-chamber to the hose. Two cross-pieces, N, limit the extent of the stroke. The volume of the air-chamber is nearly four times that of one cylinder. Six or eight persons can work this engine, and water may be thrown with it to a height of 60 feet.

A fire-engine constructed on an entirely different principle is that invented by Repsold, in Hamburg, in 1843. It works by revolving pistons, and is represented in *fig.* 7 in a side elevation; *fig.* 8 is a top view of the active machinery, *fig.* 9 a front view, and *fig.* 10 a section. On a light hand-cart, A, is placed a sliding frame, B, which can be fixed in any position by the set-screw at B. The engine, E, rests on the platform, C D; the hose, cranks, and other apparatus are carried in the box, J. The body of the engine, E, consists of a metal box formed by two cylinders partly inserted into each other, and closed at the ends with two plates. In this box play the two pistons, L and M, which are mounted on the axles of the wheels, *a* and *b*, and are turned by the cranks, F F. The pistons are of an epicycloidal form, and so arranged that their surfaces are always in close contact at a line between the centres. The larger segment of the epicycloid is in close contact with the surrounding cylinder, which is effected by a packing on the latter of lamina of metal covered with leather, *e* and *f*. G and H are the orifices by which the water enters and is discharged. The action of the engine is as follows. Whenever by turning the cranks the pistons, L and M, are set in motion, revolving in opposite directions, a vacuum will be formed before the smaller segment of one piston, and will be filled with water from the supply-pipe; the piston in continuing its revolution carries the water before it, and throws it out at the opposite orifice. In this way both pistons operate alternately, and the pressure of one will have commenced before that of the other ceases to act, thus furnishing a continuous stream of water without the aid of an air-chamber. An engine of this kind worked by four men will do as much work as an ordinary one when worked by six or eight men.

Pl. 14, *fig.* 16, represents a fire-engine mounted on carriage-wheels, as it is in general use by the firemen in cities. It differs in nothing but the larger dimensions from the portable double-acting fire-engine described above, and its operation will be readily understood by inspection of the figure. The connexion of the several sections of pipe or hose is shown in *fig.* 17. *Fig.* 21 represents a stop-cock as it frequently occurs in different parts of the engine. It will be seen that the cock, G, is so perforated as to admit the water in the position in which it is drawn; when turned at right angles to that position it will cut it off completely.

Pl. 14, *fig.* 22, is a longitudinal section, and *fig.* 23 a transverse section,

of a fire-engine constructed by Bramah, which differs essentially from those already described. Upon a strong four-wheeled truck rest the saddles *a*, cut out circularly on top to receive the cylindrical chamber B, made of staves or boards and hooped with iron: it is divided into three divisions, A, B, C. A contains the pump-cylinder; the middle portion, B, is the water-box; and C receives one of the gudgeons of the centre shaft and the levers or arms by which it is worked.

At *a'* is an opening with a closely-fitting cover, through which the interior of the water-chest is cleansed. Above the engine is a box, D, for carrying tools, at one end of which, in a separate division, is the air-chamber E; beneath the engine is a cock, *c*, to let off the water. At *d* is seen the brass pump-cylinder, 10 inches in diameter and $7\frac{1}{2}$ inches long for an engine to be worked by 10 men. Above this cylinder communicates with the air-chamber, and below with the water-chamber through the pipe *i*; *k* is a cock which establishes a communication between the pump-cylinder and either the water-chamber or with the external air, according as it is turned in one direction or the other. When water is to be drawn from a well, the cock is turned, as seen in *fig.* 22, so that the pump-cylinder *d* is opened to the tube on the left, to which is attached a suction-hose reaching to the bottom of the well.

When water is to be drawn from the water-chamber B, the cock *k* is turned in the opposite direction, opening a communication between the pump-cylinder and the pipe *i*. Beneath the central axle the pump-chamber *d* is divided by a vertical partition, reaching from the axle to the bottom of the chamber, and upon each side of the division-wall are valves in the bottom of the chamber opening inwards. The axle is packed water-tight where it enters the pump cylinder, and also at the joint between it and the vertical partition. Attached to the axle within the cylinder are two plates or pistons, one upon each side of the partition, which are packed tight by rings or disks of leather. In these plates are valves opening upwards. A reciprocating rotary motion is communicated through the brakes O to the centre axle, and the plates or pistons attached to it are thus alternately made to approach and recede from the stationary partition. The water is thus drawn through the valves in the bottom of the cylinder, and forced through the valves in the reciprocating pistons into the upper portion of the cylinder *d*, which communicates with the air-chamber E, from which the pipe passes which receives the hose.

Steam-power has also been applied to the working of fire-engines, Braithwaite in London being the first who made the attempt. *Pl.* 14, *fig.* 24, represents a side view of a fire-engine driven by steam; it works on the high-pressure principle, and has six horse-power. It has two horizontal cylinders, one of which is the steam-cylinder and the other that of the forcing-pump; the pistons of both are on one rod and act at the same time, the alternating motion of the steam-piston producing that of the plunger immediately. *a a* is a wooden frame which rests on springs that are supported on the axles of the wheels; on this wooden frame is an iron one, which supports the cylinders and other main parts of the engine; *b* is the

boiler; *c*, the cinder-box: in order to produce a rapid combustion, a blowing apparatus is contained in the box *n*, which may be worked either by the engine or by hand; *m* is the boiler-pump; *w*, the mercurial gauge; *u*, the escape-pipe; *v* is the coke-box, serving also as a platform for the fireman. The steam-cylinder has 7 inches diameter, the length of stroke is 16 inches, and the number of strokes 35 to 45 per minute. The parts belonging to the fire-engine proper are the air-chamber *r*, connected by the pipe *s* with the cylinder of the pump *p*, of 6½ inches diameter: *q* is a suction-pipe or hose which supplies water from a reservoir; or if water cannot be procured in that way, it is supplied by other engines to the water-box. This engine can throw four streams at once, if required. In Berlin there is one of the kind described, with 10-inch double-acting cylinders and 15 horse-power.

Having treated at length of fire-engines, this may be the proper place to add a few words on other means and apparatus employed to save persons and property in case of fire.

In all large cities there are regularly organized fire-companies, who are always ready to act when the alarm is given. In France the corps of firemen have a military organization under the name of *Sappeurs Pompiers.* One third of each company is always on duty, while another third is in reserve, and only the remaining third is off duty. Those on duty are engaged in patrolling through their districts, to give the alarm in case of fire. Their dress uniform is very tasteful; I, L, M, and N (*pl.* 14, *fig.* 28) are parts of the accoutrement of a pompier; K is the hat of an officer. The working-dress of course is very different; one of the main pieces is the casque, H (*fig.* 29), which protects the head against falling bodies. *Fig.* 27 represents a fireman in a safety-dress of leather, with a thick glass-plate before the face, by which he is enabled to enter burning rooms, the dress being well wetted before.

Among the apparatus used by firemen we notice the hook-ladders, A (*figs.* 28 and 29), by means of which the upper stories of buildings can be reached when the stairs are already on fire, the ladders being hooked successively on the window-sills of the several stories. It requires some art and practice to scale these ladders, which of course are nearly in a vertical position, and persons who are to be saved from the higher stories cannot be expected to descend by them; for such the fireman carries with him a long bag of leather or strong twill, B, which reaches to the ground and is held away from the house at the lower end by several persons; through this persons are sent down, sliding rapidly down the inclined bag, and are caught up below in a horizontal position. The hose, D, accompanies the fireman everywhere; a short folding ladder, E, an axe, G, and a bucket, F, also belong to his equipment. Among the larger apparatus designed for rescuing persons and property from burning houses one of the best is that represented in *pl.* 14, *fig.* 25 being a side view, and *fig.* 26 a front view; the former represents the machine when entirely raised, the latter while it is partially elevated. Like all other machines of the kind, it can only be used in cases where time and room admit of it, as it can be raised but

slowly and requires much space. A square frame, *b*, is mounted on the truck A, and supports the posts CC, which are united by ties and braces to form a square tower, the stability of which is secured by the stays HH when mounted for use. In front and in the rear is a ladder, G, which moves on a hinge at top, and when in use is braced out by the strut G′. In the interior of this tower are two more of the same kind, sliding out like the tubes of a spy-glass, the second within the first, the third within the second. The third story has on top a platform provided with a railing, from which communication with the building is established by means of planks or ladders thrown across. The several stories are raised by means of the machinery seen at the bottom, which winds the ropes *f* and *i* on a drum.

IV. MILLS.

Before entering upon the subject of Mills, it may not be out of place to say a few words upon the power by which they may be set in motion, and the improvements made in modern times in this branch of industry.

Whatever power may be made use of, it should be so arranged as to produce a rotary motion. Man-power, horse-power, steam, wind, and water, may be used, or in fact any agent capable of being employed to drive machinery. The simplest mode of driving machinery is by *horse*-power. The horse in this case is harnessed to a long horizontal lever, mortised into a vertical shaft, and is forced to travel round in a circular path, and thus the shaft is made to revolve and to give off the power to the machinery to be driven. There are a great variety of methods of making use of the power of horses for driving machinery, which are too special to be discussed in this place.

Another common motive power for mills is *wind.* This power is obtained by the pressure exerted by the wind upon the inclined arms or sails of the wind-wheel, and is thence communicated to the mill. In some cases the whole mill is made to revolve, in order to bring the wheel in a proper position to be acted upon by the wind; in others, as in the case of the Dutch mills, only the upper portions or hood are made to revolve.

Steam is also frequently employed for this purpose, but more commonly *water*, as this agent is more generally at hand to meet the primitive wants of man, before an advanced stage of the arts introduces the use of steam-mills, and the costly machinery necessary in the application of this power.

1. Vertical Water-Wheels.

Vertical water-wheels are those in which the shaft of the wheel is horizontal. Those wheels in which the force of the moving water is communicated to the buckets beneath the wheel are called *under-shot wheels;* and those which are driven only by the weight of the water which is poured

upon the top of the wheel, *over-shot wheels*. In *breast wheels* the water strikes the wheel upon a level with its axis.

Formerly water-wheels were built of wood; more recently, however, cast-iron has been used, not only for the disks which support the buckets, but also for the buckets themselves, the whole being put together by screws upon the spot where it is to be put up.

An important part of the water-wheel is the bucket, an idea of the form and position of which may be gathered from *pl.* 15, *fig.* 1. It will readily be seen that one desideratum with over-shot wheels is to keep the buckets filled with water until they reach the lowest point of their revolution; this in practice it is impossible absolutely to accomplish. At first, the buckets were placed in the prolongation of the diameter of the wheel (*fig.* 3), but in this position their power to retain the water ceased when the bucket became horizontal. Then the buckets were inclined, as seen in *gf*, *fig.* 6; but this arrangement was liable to the objection that the capacity of the buckets was much diminished, while the wheel itself was made very heavy. Subsequently the buckets were formed with two inclinations, as seen at M *o* F, *fig.* 6, which insured the advantages without the disadvantages of the inclined bucket.

Under-shot wheels, as already remarked, are those in which the water acts only by impulsion or concussion. There are many varieties of the same. *Pl.* 15, *fig.* 5, is a form often used in small but rapid streams. Where a stronger wheel and larger bucket is required, the wheel seen in *figs.* 3 and 4 is used; in this case, it will be seen that the buckets do not project beyond the sides of the wheel as in the former case.

Pl. 15, *figs.* 1 and 2, are a side and front view of an iron over-shot wheel; E is the flume which conveys the water to the wheel; *f* is the gate which regulates the flow of the water, and is worked by the screw *e*; C is the bevel-wheel which transmits the power to the machinery. *Figs.* 3 and 4 are vertical sections and plan of iron breast-wheel; A is the gate, raised and lowered by the pinion *d*, worked by crank; C is the cog-wheel which drives the machinery. In *fig.* 5 the gate E is raised by the pinion *b*, and guided by the roller *c*. *Figs.* 7 to 18 show the details of an under-shot wheel of approved modern construction, the principal parts of which are of cast-iron; *fig.* 7 is a side-view, showing the driving circles and the wheel which transmits the power; *fig.* 8 is a vertical section of one half of the whole; *fig.* 9 is a plan showing the apparatus for raising the gate and the driving-wheel L; *fig.* 10 is a vertical section through the axis; *fig.* 11 a portion of the annular disks which support the ends of the buckets, showing the grooves which receive the same; *fig.* 12 shows the construction of the buckets on a large scale; *fig.* 13, section through one of the buckets; *fig.* 14 is a section of the apron or gate, furnished with shelves forming shutes at different heights, that the water may be delivered horizontally upon the wheel, whatever may be the height of the water in the flume; *fig.* 15, pillow boxes of main shaft; *fig.* 16, the same seen from above; *fig.* 17, the box for the shaft which raises the apron; *fig.* 18, front-view of the same. The same letters indicate corresponding parts in all the drawings. A is the hollow iron shaft, running in boxes, B, upon

the masonry of the mill; C, arms of the wheel; D, sockets of cast-iron upon the axle which receive the iron arms C, and the wooden ones E; F, circles or annular plates of cast-iron made in segments, bolted or screwed together, and also secured to the iron arms C; G, an interior ring of wood which received the arms E; H, grooves for the reception of the ends of the buckets; K is the driving gear, with teeth on its interior periphery, made fast to one of the annular plates; M is the gearing for raising and depressing the gates; *n*, crank for driving the same; *o*, pinion driving cog-wheel P, on shaft *q* (*fig.* 9), which carries another pinion, engaging with the rack R of the apron or gate, which is thereby raised and lowered in the grooves in the side-walls of the flume.

2. Horizontal Water-Wheels.

Horizontal water-wheels differ essentially in their construction and operation from those already described. *Pl.* 15, *fig.* 19, is a vertical section of a *turbine* as improved by Fourneyron. F is the vertical axle which carries the horizontal water-wheel, from which the power is communicated in any known way to the machinery to be driven.

This shaft is stepped into the lever, K, having its fulcrum at P, and adjustable by means of the screw, M, upon the rod, L, so that the wheel with its shaft may be raised or lowered at pleasure; at the foot of the axle is secure the concave disk which terminates in the annular plate, A, upon which are fixed the vertical curved buckets, *a*. These buckets perform a duty analogous to that fulfilled by the buckets of the vertical wheels, receiving the impulse of the water and transmitting it to the machinery to be driven: *nn* is a tube by which the step, *m*, is oiled. The water flows from the flume above into a cylinder, DD, and thence into the cylinder containing the curved guides, *b*, *b* (*pl.* 15, *figs.* 19 and 20), which serve to guide the water upon the wheel, that it may strike the buckets perpendicularly. This cylinder rests upon a flange, *i*, of the tube, G, which surrounds the shaft of the wheel, the latter turning freely whilst the guide cylinder remains stationary. In order to regulate the force of water upon the wheel, the cylindrical gates, C, are so arranged as to be raised or lowered by the rods, E, attached to the ring, *d*, to which the gates, C, are secured.

At the bottom of the gate, C, are wooden wedges, so formed as to fit into the guide curves, and close the openings to the water-wheel in proportion as the gate is depressed.

Pl. 15, *fig.* 21, is a section; *fig.* 22 a front view, and *fig.* 23 a plan of a turbine of a little different construction, which will be easily understood from what has gone before; *f* is the water way; *h* the gate. The back-water passes off through the channel, A, and above is seen, at *b*, *m*, *n*, the machinery for transmitting the power.

In order to lessen the friction upon the step of the vertical shaft in wheels of this description, Nagel in Hamburg conceived the idea of admitting the water to the wheel from below, instead of above, which he did with the happiest effects, increasing the power of the wheel from 55 per cent. to 80

per cent. of the power applied. *Pl.* 15, *fig.* 24, is an elevation of a wheel arranged in this manner; *fig.* 25 a plan; *fig.* 26 a section of the wheel upon a larger scale; *fig.* 27 shows the bearing of the main shaft; *fig.* 28 a vertical section of the water passage; *fig.* 29 a view of the small gate; A is the flume; B the wheel secured to the shaft, C; D, the stationary curves which conduct the water to the wheel, and are secured to a nave made fast to the vertical post, F, in such a manner as to be easily raised or lowered; G is a gudgeon made fast by the wedge, X, to the vertical post, E, to which the wheel, B, is hung. The oiling of the gudgeon is accomplished by means of the canal, *y*, bored through the shaft, C, of the wheel (*fig.* 26). The guide-curves serve also the purpose of a gate to admit the water, and are raised and lowered for that purpose in the following manner (*fig.* 24). The rods, *n*, passing into the opening, *m*, of the nave carry the guide-curves; these rods, by means of the joint, *op*, and levers, *pq*, are connected with the rod, *s*, passing through a stuffing-box, and moved by the lever, *r*, and vertical rod, *t*.

3. Grinding Mills.

With mills as commonly constructed and arranged every one is supposed to be familiar; having therefore already noticed the power by which they are driven, we will turn our attention only to some important improvements which have been made in the United States during the last fifteen years, and which are now generally introduced into Germany and other parts of Europe. Amongst the advantages which these improvements possess are the following: 1st. A much larger proportion of superfine flour is obtained from the grain. 2d. The flour is better adapted to keeping and to transportation to hot climates, being in a great degree deprived of its moisture, and this without kiln-drying the grain, which has not been found fully to answer the purpose. 3d. The compactness and general arrangements of the machinery, together with the use of cast-iron for the mill-shafts and gearing, materially lessens the friction of the running parts, the frequent recurrence of breakages, and the consequent cost of repairs.

In *pl.* 16 is a system of mills upon the American plan for six run of stone; *fig.* 1 is an elevation, *fig.* 2 a vertical section through the main driving-shaft, *fig.* 3 a vertical section perpendicular to the latter, *fig.* 4 a section showing the disposition of the stones, *fig.* 5 a portion of the ring supporting the vertical shafts of the stones, *fig.* 6 a view from above, *fig.* 7 a view from above of the ring upon which the separate shafts are supported, *fig.* 8 a vertical section of the mill-bush in the stationary stone, through which the vertical shaft which drives the upper stone passes, *fig.* 9 the horizontal section of the same; *fig.* 10 vertical section of the upper portion of the boxes in which the mill-shafts run, with the apparatus for raising the same; *fig.* 11, plan of the same; *fig.* 12, horizontal section immediately above the mill-spindle, *fig.* 13, horizontal section immediately above the base of the column; *fig.* 14, horizontal section immediately over one of the

driving-wheels, T; *fig.* 15, box in which the spindle of the main driving-shaft rests. The same letters indicate corresponding parts in all the figures. The base, A, carries the pedestal, B, and the columns, C, which support the flooring, D, carrying the ring E, which supports the different bed-stones. Upon the bed, D, are the triangular frames, F, regulated by set-screws, and upon which the bed-stones, F′, rest, while the runner-stones, F″, hang upon the top of the upright shafts, G. Within the bed-stone is the mill-bush, H, through which the shaft, G, passes. In the eye of the runner-stone is the rind, *f*, and the tube, *l*, which feeds the grain to the stones, from the receptacles, *v*, to which it is brought by the tubes, *s*, from the room above. The runner, F″, is raised and lowered by a suitable arrangement. The shaft, G, which carries it, is supported in a box, *j*″, on the top of the hollow column, J, within which is a rod, I, on which the above named box rests; this rod rests upon a lever, K, which is raised or lowered by a rod, L, passing up through one of the columns, C (*fig.* 4), by which means the box, *j*″ and with it the shaft which carries the runner-stone, is raised and lowered.

The whole system is driven by the main-wheel, M, upon the horizontal shaft, N, which is in gear with the driving power (*fig.* 7). Upon the other end of this shaft is a bevel wheel, O, which engages with another wheel, P, upon the upright shaft, Q, carrying the large cog-wheel, S, which drives the smaller wheels, T, upon the shafts of the mill-stones. The stones are inclosed in cases, U, which prevent the waste of the flour; from these cases the flour is delivered into a circular trough X (*fig.* 3), in which are made to revolve the arms or scrapers, *x*′ (*fig.* 2), which sweep the flour round into another trough, through which it is carried by the screw-formed *conveyor*, Z, to the elevators, Z′, seen at the right hand upper corner of the machine in *fig.* 3.

Upon the main shaft is a small pulley, *c*′, from which a band passes to the governor, A′, which regulates the velocity of the steam-engine, and consequently of all the machinery driven by it.

In all well arranged mills the grain, before being ground, is freed from foreign substances; this is sometimes accomplished by passing the grain through a cylindrical riddle, furnished with screw-formed divisions on the inside, so that as the riddle revolves the grain passes over a great extent of surface, and is measurably freed from dust and other extraneous substances. Very perfect machines have been invented and put into use for the purpose of cleaning grain, which is accomplished in most of them by subjecting it first to friction and then to a current of air which carries off the impurities. By one process recently invented in the United States the grain is not only freed from the impurities which it may contain, but entirely deprived of its hull or skin. This process is briefly as follows: the grain is moistened for a few seconds in either steam or water, and is then passed through rubbers, which take off the outer skin entirely, leaving the useful portion of the grain clean and white; from the rubbers it passes through a kiln, in which it is again dried, and then it is run through a fan which blows off all the impurities with the skin, leaving the grain ready for the mill; it is then ground, and may be packed at once in barrels, as it requires no bolting or any further preparation. The seeds of garlic and other weeds, which have

heretofore proved so troublesome to the miller, are by this process entirely removed. The preliminary soaking, which is just sufficient to moisten the skin of the wheat, entirely penetrates other seeds, so that they are subsequently ground or crushed in the rubbers, and after being dried are blown off with the hull of the grain. It is said that by this process fifteen per cent. more flour is obtained from wheat, and at a less expense, than by the usual process of grinding and bolting.

The mill-stones in use in the United States and Europe are mostly made of a porous silicious stone obtained from France. As this stone is not obtainable in masses sufficiently large to make the mill-stones in a single piece, they are put together in smaller pieces with cement and secured by iron bands. After being accurately balanced, the stones are cut upon their grinding surfaces, as seen in *pl.* 16, *fig.* 6. The bed-stone must not only be adjusted level, but concentric with the axis of the spindle. To accomplish the first, the bed-stone rests upon a frame, F, which is adjusted by three screws, one under each corner. The centring of the stone is accomplished by means of screws working against the sides of the stone (*pl.* 16, *fig.* 6).

The operation of the mill-bush is seen in *figs.* 8 and 9. This bush is of cast-iron, and is secured in the centre of the bed-stone. Three pieces of brass or wood rest against the mill-shaft, and are pressed against it by screws, in order to perfectly adjust the main shaft in the centre of the bush; the interstices not occupied by the brass or wooden blocks are filled with oakum or tow saturated with oil, in order to lubricate the bearing. After the grain is ground, it is necessary that the flour be thoroughly cooled before it is bolted; where there are no arrangements for effecting this, the flour has to remain twenty-four hours before being bolted. In most mills, however, this is accomplished by a machine, also an American invention, called the *hopper-boy*. The flour is run into a circular room, where it is stirred by revolving arms until it is completely cooled, when it passes immediately to the bolts, where the preparation of the flour is finished.

V. COTTON MANUFACTURE.

Cotton is the production of a genus of tropical plants of which there are many species; these again run easily into varieties, so that there have been enumerated over one hundred different sorts. The dwarf varieties found in America, India, and China grow to a height of eighteen inches to two feet; the blossoms are a pale yellow and are succeeded by triangular three-celled seed-vessels, which gradually turn brown as they ripen, and ultimately burst open, exposing the cotton fibres wrapt round the seed. The shrub and tree cotton grow in America, the West Indies, East India, Egypt, &c., the latter reaching a height of from 12 to 20 feet.

When cotton is to be spun, it is first subjected to the operation of *ginning*, to separate it from the seeds. This is performed upon the plantation where it is grown, as when packed with the seeds it becomes oily and soiled, and

is unfit for manufacturing purposes. The close adherence of the fibres to the seed renders this a tedious operation, which is now entirely performed by machines called *gins*. That most commonly used in the United States is the *saw gin*, of which *pl.* 17, *fig.* 1, is a section, *fig.* 2 a plan showing the saws and brush cylinder. The prominent parts of the machine are two cylinders of different diameters, F and H, which lie in a strong wooden frame, and are set in motion by crank, bands and pulleys, or other means.

Upon a horizontal axle *ff*, circular steel plates or saws are secured, the circumference of which is filled with sharp-pointed inclined teeth. These plates, which are 10 to 12 inches in diameter, and half a line thick, are separated a distance of 9 lines from each other by small washers. In front of this saw-cylinder, and secured to the main frame of the machine, is a grating of bent iron bars, placed so near each other that the saws can just pass between them without rubbing. This grating forms a portion of the forward side of the hopper L, which receives the cotton to be operated upon. Connected with the back wall of the hopper is a strip hung upon hinges, and adjusted by a set of screws, by which means the opening through which the seeds pass when cleaned is regulated. Behind the saws, and parallel with their axis of rotation, is the drum H, carrying six horse-hair brushes, *cc*. The saws and brushes move in contrary directions, the former making about 100 and the latter 150 revolutions per minute. The teeth of the saws, which project more or less between the rods of the grating into the hopper, seize the fibres of cotton and draw them through, whilst the seeds, being too large to follow, fall through the opening at the bottom of the hopper into the box N below; the cotton is then swept off the teeth of the saws by the revolving brushes. The brush-cylinder also acts as a ventilator, which partially cleans the wool. The ginned cotton falls upon the inclined table O, and thence into the box P; such a machine requires two-horse power to move it, and turns out 5000 lbs. of cotton per day.

1. Picking, Scutching, and Lapping Machines.

The first operation in cotton-spinning is to pick open the closely packed mass, and separate the sand and other foreign substances which it may contain. The finest cotton, as the Sea Island, is first opened by hand, spread upon a table of coarse netting called a *flake*, and beaten with rods by women and children. The shaking of the net-work loosens the cotton and frees it from sand, whilst the larger extraneous substances are picked out by hand. This labor was tedious and expensive, and machines have been invented to perform it. One of the best and most common for this purpose is the *wolf* or *willow*, originally a cylindrical willow basket, but as now constructed, a most powerful and effective machine. *Pl.* 17, *fig.* 3, represents an exterior view of a conical willow, showing the side which receives and delivers the cotton; *fig.* 4 is an end-view, and *fig.* 5 a plan, a portion of the covering and frame being removed to show the interior mechanism. *Fig.* 5 *a* shows the perforated plates on the grating which forms a portion of the bottom

casing round the cone. The cone A consists of a strong shaft, *aa*, carrying three cast-iron rings, one at each end and one in the middle, on which the sheet-iron is secured which forms the surface of the cone.

Longitudinally upon this surface are four iron rods, in which are secured rows of strong iron pins, *bb*; upon each side of the framework is a row of pins, *dd*, corresponding to the spaces between the pins upon the cones. The cone is surrounded by a concentric covering, the bottom of which consists of a grating or perforated plate; at the small end of the covering is a rectangular opening, *e*, connected with the frame D, in which travels the endless feeding apron E, which consists of parallel stripes of thin sheet-iron, $\frac{3}{4}$ inch wide, and secured half an inch apart, upon endless bands of leather running upon rollers.

At the larger end of the machine is a chamber, F, into which the cotton is thrown by the revolving cone, whence it is received by an endless apron similar to the feeding apron, and shown by dotted lines at G G. About an inch above the apron, and upon an axis parallel thereto, revolves a wire cylinder, H, having a sheet-iron covering which communicates with the chamber F by the openings *ff*. Above the wire cylinder is a ventilator, which draws the dust of the cotton through the wire cylinder from the chamber F, and blows it out at the opening *g*. The wire cylinder seems not only to prevent the cotton from being blown away with the dust, but lays it upon the delivering apron, and is connected with the ventilator by means of a covering of sheet-tin, which embraces the openings at the ends of both these cylinders, the dust passing through the meshes of the wire cylinders being blown out by the ventilator.

The motions of this effective machine are as follows: Upon one end of the shaft *a* of the cone A, are the usual fast and loose pulleys K, and upon the other end the two pulleys *i* and *k*, of which the former communicates motion to the ventilator, by a band upon the pulley *l*. From the pulley *k* an endless band drives the pulley *m*, upon the axis of the roller carrying the delivering apron. Upon the axle of the latter roller is a pulley, *n*, which gives motion by another band to the pulley *o* of the wire cylinder H. Upon the other end of the last-named axle is a pinion, *p*, which drives the wheel *q*, and the small pulley *r* attached to it. From the latter a band runs to the pulley *s*, upon an axle *t*, having a universal joint, which permits the deflection of the direction of its motion to one parallel with the exterior surface of the cylinder. The universal-jointed axle *t* runs in boxes in the frame D, and carried a cog-wheel, *u*, which engages another cog-wheel, *v*, upon one of the rollers of the feed apron, by which means the latter is driven.

The operation of the willow is as follows: The cotton, which is gradually carried to the machine by the feeding apron, is torn open at the smaller end of the cone, and its heavier impurities, dust, stones, &c., fall out; the cotton being carried by centrifugal force to the other end of the machine, the lighter particles of dust are thrown through the cylindrical revolving sieve. This is a powerful and safe machine, and capable of cleaning 7200 lbs., or 24 bales of cotton per day.

The next operation to which the cotton is subjected is performed by what are called *batting* (*beating*), *scutching*, and *blowing* machines, by means of which the fibres of the cotton, which have been loosened by the willows, are more perfectly opened, and by the use of sieves and ventilation entirely freed from dust. The beating is accomplished by flat rods, which strike the cotton whilst it is slowly carried through the machine upon endless cloths.

In each machine there are generally two beating arrangements, from the second of which it is taken to a new machine, called a *lap* machine, which, after again blowing and scutching the cotton, coils it upon a wooden roller, in the form of a lap or sheet.

The first blowing machine serves to prepare the cotton for the second, and is sometimes called a *spreading* machine; it is shown in *pl.* 17, *fig.* 6. The frame is of cast-iron and is covered in with boards, only the necessary openings being left for the introduction and extraction of the cotton and the separation of the dust. The feeding takes place through an endless apron, *a*, which runs over two wooden rollers, *b* and *c*, by the revolution of which it is moved. A table, *d*, between the rollers *b* and *c*, on the surface of which the feeding apron travels, serves as a support for the latter, and keeps it always flat. The cotton is spread by hand upon this apron, which feeds it with the utmost regularity to the fluted rollers, *e*, by which it is drawn in and subjected to the operation of the beater or scutcher, *f*, which consists of an axle and two arms, which carry thin iron beaters with rounded edges.

Beneath the beater is a curved grating of iron wire, *n*, which permits the dirt and seeds to fall through, whilst the filaments of cotton are blown upon a second apron, *a′*, which conducts the cotton to the second scutcher, *f′*, arranged precisely like the first. In order that the cotton may be delivered regularly to the feeding rollers *e′*, it is pressed down upon the apron by a wire-gauze squirrel-cage, *h*, which bears with its whole weight upon the feeding apron, *a′*, and transfers to it, in the form of a sheet, the cotton which is blown against its circumference. The dust and short fibres of cotton are blown through the meshes of the sieve, from which they are again drawn off by a sucking fan-ventilator above.

The second beater drives the cotton through a long wooden canal, *xx*, a portion of the floor of which consists of a grating of inclined slats. The progress of the cotton through this canal is assisted by a ventilator, *m*, placed beneath the beater.

The second blowing-machine, called a lap-machine, because it converts the cotton into a lap or sheet, resembles in its elements the before described machine, and is represented in *pl.* 17, *fig.* 7. The cotton, which, by the pressure of the wire-gauze drum *h*, is already measurably compressed, passes from the endless apron *op*, between the two smooth rollers *r*,*s*, which are pressed together by heavy weights, and serve to give the sheet of cotton an additional degree of firmness. As it leaves these rollers the lap is rolled upon a wooden roller, *v*, whose gudgeons run in vertical grooves, which permit it to rise as the size of the roll of cotton increases. This roller rests upon the revolving rollers *t*,*u*, covered with leather, by friction upon which

the lap-roller is turned; and thus the winding of the lap takes place with entire regularity. A weight is hung upon each end of the roller *v*, for the purpose of giving firmness to the lap.

With this machine first commences the determining of the fineness of the thread to be spun. As this fineness depends upon the weight of a given length of thread, the manufacturer must keep himself informed in the whole course of his operations of the length produced in each step of the process by a certain quantity of cotton. This comparison must commence with the lap-machine.

The cotton is spread upon the feeding apron, *a*, not only with great regularity, but care must be taken that a specified weight of cotton be distributed upon a certain length of cloth. To the accomplishment of this end the cloth is divided into equal lengths by red and black lines, and the cotton is weighed in small portions as it comes from the first blowing-machine, so that an equal quantity of cotton is always distributed upon an equal distance of the apron. When a number of such portions of the apron requisite to fill the lap-roll have passed a division is left empty, that the laps may be separated from each other as they come out of the machine.

Carding is the next operation to which the cotton is subjected; its object is to draw out the imperfectly opened fibres, to lay them parallel with each other, and to cleanse the cotton more perfectly. The operation consists in the mutual action of two contiguous surfaces, both furnished with hook-formed elastic teeth of hardened iron wire, of the form seen on *pl.* 17, *figs.* 8 and 9. These wires are bent and placed in the card-plates by machinery, the utmost regularity being requisite in both operations, otherwise an uneven fabric would be the result. American ingenuity has given birth to the most beautiful automatic machines for making these cards. Mr. Ellis's machine has been justly characterized by an English writer on the subject as "one of the most elegant automatons ever applied to productive industry." The leather and wire are furnished to the machine in rolls; the former is shaved to a uniform thickness and pierced with the requisite holes to receive the wire, which is cut into proper lengths, bent, and passed through the leather, and the strips of *card cloth* leave the machine completed. Suppose *a* and *b* (*pl.* 17, *fig.* 11) to be two cards whose teeth are set in opposite directions, and whose surfaces are parallel and at a short distance from each other; suppose a bunch of cotton to lie between them; let *a* move in the direction of its arrow, whilst *b* remains stationary or is moved in the opposite direction; the teeth of *a* tend to carry the cotton with them, whilst those of *b* retain it, or carry it in the opposite direction. Each of the cards takes a portion of the cotton, the small bunches are all drawn apart, and the fibres laid in a parallel direction. If the cards are placed as in *pl.* 17, *fig.* 10, the teeth pointing in the same direction, and *a* be moved in a direction contrary to that indicated by its arrow, whilst *b* remains stationary or moves slower than *a*, then *a* will comb the wool out of the teeth of *b*, since the hooks of *b* have in this position no power of retaining it. By considering these two relative positions of the cards, which take place in hand cards simply by reversing one of them, any person will be able to under-

stand the play of a cylinder card against its flat top, or against another cylinder card, the respective teeth being in what we may call the teasing position (*fig.* 11), and also the play of a cylinder card against the doffer cylinder, in what may be called the stripping position (*fig.* 10). Generally one carding is not sufficient for long-stapled wool. In order to produce the requisite lightness and parallelism of fibre, the cotton is twice carded; first in what is technically called a *breaker*, and afterwards through the *finisher*. The card cloth is placed upon cylinders or plane surfaces, the latter being at rest and the former revolving in contact with them. Sometimes large cylinders work against the surfaces of small ones moving with less velocity than the large ones. *Figs.* 12, 13, and 14, represent a carding machine combining both the above systems in one; *fig.* 12 is a longitudinal section; *fig.* 13, a view of the end from which the carded cotton leaves the machine; and *fig.* 14, an end view in which the principal wheelwork for the motion of the machine is shown.

A is the main card drum, consisting of parallel segments of mahogany secured by screws to iron rings made fast to the axle. Upon each of these segments is nailed a strip of card cloth, the length of which is equal to the width of the drum. The direction of the card teeth is apparent from the figures. B B are parallel segments of mahogany, resting at their ends upon the heads of screws, *b b*, upon the frame, C, of the machine, and maintained in their places by pins passing through their ends. The interior surface of these segments is covered with stripes of card cloth, and they are then called *top flat cards;* their distance from the drum, A, is regulated at each end by the set screws, *b b*, which arrangement is seen in *fig.* 14. D, E, F, G, are rollers covered with narrow strips of card cloth running spirally from end to end. These small cylinders, called *runners*, *urchins*, or *workers*, revolve in supports, *d*, *e*, *f*, *g*, which are furnished with set screws for the purpose of adjusting the distance of these small cylinders from the main card cylinder. At H are two fluted cast-iron feeding rollers pressed together by a screw; *h* is a feeding table which conducts the fleece to the feeding rollers as it is given off from the lap roller by the friction of the revolving roller, K. The first cylinder card or runner, D, moves slower than the main card drum, takes the fibres from the feeding rollers, and is therefore called the *licker-in;* these fibres are immediately stripped off by the main drum to be again drawn out by the second roller, E, which revolves slower than D, and serves to take the knots of uncarded fibres off the main cylinder, and carry them round and transfer them to the licker-in, D, with which it is almost in contact, which again transfers them to the main cylinder with the fresh cotton from the feeding rollers. The knots or bunches which escape the two first rollers, D and E, are seized by the fourth roller, G, which lies nearer to the main cylinder, and revolves with the same velocity as the runner E. The knots caught by G are drawn out again by the roller F, also called a *stripper* from the office its performs, which travels faster than G, but not so fast as the main cylinder. From F the fibres are again transferred to the main drum, which carries them forward and draws them again a second time over the runner. Should any uncarded knots still remain they are stopped by the first flat

top card, on the surface of which they remain until entirely carded out by the revolutions of the drum. On this account the first top cards require cleaning oftener than the others. The fibres of cotton are now, after being subjected to the operation of the top cards, taken off by the small cylinder, L, called the *doffer*, which is clothed with spiral strips of card cloth, and revolves in contact with the main cylinder. By its slow motion, in a direction contrary to that of the main cylinder, the doffer strips the cotton from the main cylinder drum, and clothes itself with an exceedingly thin fleece, which is taken off upon the opposite side of the doffer by the *doffing knife*, M. This apparatus consists of a steel plate, the lower edge of which is finely toothed, and which has a rapid up and down motion imparted to it tangentially in contact with the surface of the cylinder. The cotton is thus *combed* off in a thin bat of the width of the doffer cylinder, but it is immediately condensed into a small riband or *card end* by passing through a funnel, *i* (*fig.* 12). This card end, called also a *sliver*, is drawn forwards by the rollers seen at N. This apparatus consist of three pairs of cast-iron rollers, *k*, *l*, *m*. The underneath rollers, *k* and *l*, are finely fluted, and the upper ones are covered first with flannel, then with leather, to give them a smooth elastic surface.

The upper rollers are pressed firmly against the lower ones by uprights. As the rollers *l* revolve with greater velocity than the rollers *k*, the card end is drawn and extended between them. After the fleece has been converted by the action of the rollers into a flat riband, it again receives an elliptical form by passing through a vertical slot in a metallic plate, through which it is drawn by the rollers, *m*, which are pressed together with but little force. The card end now has a very open, spongy texture, and scarcely sufficient tenacity to hold itself together. From the last pair of rollers it falls into tin cans, *o*. In many manufactories the card ends from several machines are wound immediately upon a lap roller or large bobbin, ready to be taken immediately to the drawing-frames. In other factories the card ends as they run from a number of machines are united together and conducted through wooden troughs, and at last are wound upon a large bobbin into a fleece of parallel ribands ready to be taken to the drawing-frame.

Motion is communicated to the different parts of the machine in the following manner. Upon the axle of the main drum, without the frame of the machine, are the ordinary fast and loose pulleys, and a smaller pulley (*fig.* 14), giving motion by a crossed band to the stripper, F; also a pulley, R, seen in dotted lines in *fig.* 12, communicates motion through a crossed band to the licker-in, D. There is also another pulley, S (*figs.* 12 and 13), upon the axle of the main cylinder which drives the pulley, T, on the axle of which are two cranks (*fig.* 13) which communicate a rapid up and down motion through the rods, *p*, to the toothed knife, M. The rods, *p*, are guided by the horizontal arms, *o*, which are so adjusted that the knife vibrates in contact with the surface of the doffer cylinder, L. Upon the opposite end of the main cylinder shaft is a pinion, *m*, which engages with a wheel, 2, on whose axle is another pinion, 3, which meshes with a wheel, 4, producing a slow motion which the latter wheel transfers to the doffer cylinder, L,

through the wheel, 5. A band from the axle of this cylinder drives the workers E and G as shown by the dotted lines in *fig.* 12. Upon the other end of the axle of the doffer is a bevel pinion, 6, which by means of the oblique axle, U, and the bevel gearing, 7 and 8, drives the lower feeding roller. From this feeding roller, by means of an intermediate wheel, 9, motion is communicated to the roller K, which unwinds the lap roller I. The wheel, 2, already mentioned, drives another wheel below it, 11, and a pulley upon the same axle; from which pulley motion is communicated to the drawing rollers at N (*fig.* 14).

The axle *g* has upon one end two wheels, one of which drives both pairs of drawing-rollers, *l* and *m;* the other drives a larger wheel upon one of the rollers, *k*, so that this pair has a slower motion than the others; *l* and *m* move with nearly the same velocity; *m*, being slightly larger than *l*, has a somewhat greater surface motion. That the two rollers *m* may run together, they are connected together by small wheels, *t*.

As before mentioned, in most manufactories the cotton passes successively through two carding-machines, the breaker and the finisher; this is particularly the case with that destined for fine work. *Fig.* 15 is an end view, *fig.* 16 a plan of a fine carder or finisher.

2. The Drawing-Frame.

We turn now to another operation, the principles of which differ essentially from those of the former. It has for its object to draw out and lengthen the loose ribands of cotton furnished by the carding-machine, and also to complete, as far as possible, the parallelism of the fibres. This operation, the *drawing and doubling*, is performed by rotary drawing rollers, and is a very important step in the process of spinning. Upon this principally depends the uniformity of the cotton, as many ends are united in one and the faults of each are lost in the crowd. The drawing, when properly executed, completely does away with all these faults.

Pl. 17, *figs.* 17–20, represent a drawing-frame of the most approved construction; *fig.* 17 is an end and *fig.* 18 a front view; *fig.* 19 a section of the working parts of the machine upon a larger scale, and *fig.* 20 shows the manner in which the upper rollers press upon the lower ones.

A is the frame, upon the strong cross-timbers, B, of which the drawing-rollers are placed, as seen in *fig.* 18; C is a horizontal axle furnished with pulleys, D, which drive the drawing-rollers. In *fig.* 19, *a b c* are the lower, *a' b' c'* the upper drawing-rollers. The former run in composition-boxes in an iron frame, *d*.

The bearer of the first roller, F, is stationary, but the two others are adjustable, and can be brought more or less near to each other and the forward rollers, according to the length or *staple* of the cotton to be operated upon. The length of the upper rollers is equal to that of two fluted portions of the under rollers, as seen in *fig.* 18, and the upper rollers run with their necks in boxes, which are adjustable like the bearings of the under rollers.

In the middle of each of the top rollers, *a′ b′ c′*, are smooth necks supporting composition-boxes, *e* and *f*, upon which are suspended weights, *g* and *g′*, by means of wires, *h* and *h′* (*figs.* 19, 20). Generally the two back rollers, which move the slowest, are pressed down by a common weight, whilst the front roller has a separate weight.

The three other rollers are covered with a bar of mahogany, *i*, which is covered underneath with flannel, and wipes off any fibres left remaining upon the surface of the roller. A corresponding bar, *b*, about one inch thick, and covered upon its upper surface with flannel, of the length of the drawing-roller, is pressed against the under side of the two forward rollers, *b* and *c*, by means of the small weight *m*. This bar also serves to keep the forward rollers free of fibres. The cord or wire upon which *m* hangs goes over the roller *e*, and then down again, in order to support the wiper bar *l*.

In *figs.* 17 and 19, G represents a smooth curved plate of brass, with curved channels upon its surface, which conduct the slivers *nn* from their respective *cans*, H, at the back of the machine to the drawing-rollers. The slivers are kept apart by the pins *o* in the brass rod *p*. In this manner three to six slivers are united upon each division of the fluted rollers, and are extended by the drawing-rollers, particularly the front pair, into one thin, uniform, and much elongated sliver. Generally two such slivers are conducted through a funnel, I, and pass off through the smooth rollers K into the cans L.

The motions of the machine are as follows: N is the usual fast-and-loose pulley on the prolongation of the shaft of the lower forward drawing-roller; this pulley is driven by a band from the pulley D upon the shaft C; upon the same front roller shaft is also a pinion, which, by means of the intermediate wheel 2, drives the wheel 3 upon the end of the smooth roller K (*pl.* 17, *fig.* 18). Upon the other end of the forward fluted roller *c* is a pinion, which drives the shaft *o* by means of the wheel 5. By the side of the latter wheel and upon the same shaft is another small wheel, 6, which drives a larger wheel, 7, upon the prolongation of the lower middle roller *b*. Upon the other end of the shaft *o* is the wheel 8, which engages with a wheel, 9, upon the back lower roller *a*.

Having examined the operation of the drawing-frame, we will notice more closely the changes brought about upon the fibres of the cotton. Were the surface velocities of the three rollers *a b c* equal, the slivers *nn* would pass through the machine unaltered. As, however, the velocity of *b* and *c* is greater than that of *a*, the former will deliver a greater length of riband than they receive from the latter, or than this receives from the cans H, and there results, in consequence, an extension of the riband between the rollers *a*, *b*, and *c*, and a proportional approach to parallelism in the fibres during the process. The distances between the drawing-rollers, *a*, *b*, and *c*, are so adjusted to the staple of the cotton that no disruption of the fibres will take place, which must inevitably occur if the length of the individual fibres were less than the distance between the rollers.

It would be impossible to continue the drawing upon a single sliver until the requisite parallelism of fibre were attained, on account of the excessive

attenuation of the riband; this inconvenience is obviated by the simple expedient of uniting together several of the formerly drawn slivers at each repeated drawing. This operation is called doubling, and insures this advantage, that the uneven portions of the slivers mutually correct each other, and finally a uniform riband results.

3. The Roving Frame.

The next operation after the above-described process of drawing is the preparation of the roving, which is a thin sliver with a slight twist. In the tube-roving frame this twist is only momentary. In this stage of the cotton manufacture the greatest care is necessary to preserve the uniformity of the spongy cord, upon which the evenness of the yarn depends. Since the first can-roving frame, invented by Arkwright, numberless machines have been contrived for performing this operation with exactness. In Arkwright's machine the slivers, after passing through the ordinary drawing-rollers, received a slight twist by the revolution of the tin cans into which the roving fell, and around the interior surface of which they were regularly coiled by the centrifugal force. This machine is in fact the ordinary drawing-frame (*pl.* 17, *fig.* 17), with the receiving-can revolving on a pivot. This frame, though effective in the hands of its inventor, was still defective; the torsion was unequal upon different portions of the yarn, and even when the twist was put in it was liable to be deranged as it was drawn from the cans.

A machine constructed upon the principle of the common spinning-wheel is in very common use for the preparation of the rovings. The difficulty with these machines arises from the soft and delicate nature of the roving and the care necessary to regulate the winding-on, that it be neither slower nor faster than the delivery from the front rollers. The care required was increased by the constantly varying size of the bobbin within the flyer, as successive layers of roving were wound upon it, as well as by the changes occasionally required in the degree of twist to be given to the roving for particular purposes.

The operation of this machine, called the *bobbin-and-fly frame*, is two-fold, twisting and winding. The twisting is accomplished by the revolution of the spindle, F (*figs.* 21 *a* and 21 *b*), to which the fly-fork is united, whilst the sliver, A, in its progress from the rollers to the bobbin, passes through the hollow arm, H, which being made in one piece with the spindle, revolves with it.

The amount of twist given to the roving depends upon the relative surface velocities of the drawing-rollers and the bobbin.

The winding-on is accomplished by giving such a velocity to the bobbin that the difference between the motion of the surface of the bobbin and the motion of the delivering end of the flyer-arm is equal to the surface motion of the roller supplying the sliver.

The first on the list of machines of this class is the tube-roving frame of

Danforth, an American invention, introduced, however, soon after its invention into the factories of England and other countries. The twisting of the roving, as it comes from the front drawing-rollers, is here performed by revolving tubes, through which it is made to pass on its way to the bobbins. The latter consist of simple hollow wooden tubes without ends, which rest upon iron axles, and are moved by friction upon horizontal iron drums or rollers, upon which the bobbins bear by their own weight, whilst the feeding tube has a transverse motion for the purpose of distributing the roving upon the bobbin. This transverse motion is diminished gradually as the spool increases in size, for the purpose of producing conical ends. This machine contains a drawing arrangement similar to that already described.

Pl. 17, *fig.* 22, shows one end, and *fig.* 23 the other of the machine. In the latter the three pairs of drawing-rollers are seen in section at A, and in the former an outside view of the front rollers, B, is given, to show their arrangement upon the roller beam, C. The position of the usual fast and loose pulleys upon the main shaft, *a*, is indicated by dotted lines, as also the large pulley, $c\,c'$, which communicates motion to the revolving tubes. *Pl.* 18, *fig.* 1, is a portion of the forward view of the machine, to show the working gear and the manner in which the bobbins are filled; *fig.* 2 shows the principal spinning parts of the machine on a large scale; *fig.* 4, a forward view, showing some details subservient to the traverse motion of the tubes; *fig.* 6, a side view of the same. A^7 B^7, *pl.* 17, *fig.* 22, are the two rows of drawing-rollers, which receive the rovings as they come from the cans behind the machine. After the rovings have passed the front rollers of the first set, they enter the back pair of the front set, both sets revolving with equal velocity, and are delivered by the front roller of the second set to the bobbins in slender *slubbings*. The bobbins are arranged in a line in front of the machine and rest upon fluted rollers, D, the common axle of which passes longitudinally through the machine. These rollers are fluted for the purpose of creating friction upon the surface of the cotton-covered bobbins, one of which is seen at E (*pl.* 18, *fig.* 1), filled and in its place, and revolving in slots in the upright pieces *d*, by which arrangement the bobbin is enabled to rise as it increases in diameter. *e e* (*pl.* 17, *fig.* 23) are several arms secured to the roller-beam, C, upon the inclined surface of which the bearings, *f*, receive an up and down motion by means of the pinions, *g*, engaging in the racks, *h*. The part *f* of these bearings serves to slide a small iron frame, *i*, best seen in the section *fig.* 3. Upon its surface are secured the bearings *l l*, in which the carriers of the revolving tubes may vibrate or swing on an axis, as seen at one point in *pl.* 18, *fig.* 1. *m m* (*fig.* 3) are the tubes revolving with their ends in the carriers, *k k*; *n* is a guide plate for conducting the roving after it has received a momentary twist in the tubes; *o* is a catch attached to the carrier, *k*, to hang it upon an iron rod running the whole length of the machine, when the bobbins are to be changed; at other times it presses with the plate, *n*, upon the roving of the bobbin, E.

As the roving is being wound upon the bobbin, the frame, *i*, with the carriers, *k k*, gradually rises by means of the pinions, *g*, engaging in the

racks, *h*, of the bearings, *f*, thus producing a constant pressure of the delivering ends of the tubes, *m m*, in the same direction upon the bobbins, E, which being turned by the roller, D, wind up the roving as it passes from the opening in the plate, *n*. At the same time the frame, *i*, is sliding to and fro in a direction parallel with the axis of the bobbins, for the purpose of distributing the roving evenly upon their barrels. The extent of this sliding motion is shortened a little each time for the purpose of forming the ends of the bobbins into a conical shape. When the bobbins are full the machine is adjusted to stop itself by throwing the driving band from the fast to the loose pulley. The motions of the machine are produced as follows:

The dotted circle *b b* (*pl.* 17, *fig.* 23) indicates the position of the driving-pulley, and *c c′* a larger pulley, from which a strap runs over the pulleys *r*, *s*, and *t*. The strap then passes the whole length of the machine and over the pulleys *u* and *v* at its other end (*fig.* 22). This strap, in its progress from the pulley *s* to the pulley *u*, passes round the tubes *m m*, in such a manner as to go over one of the tubes and under the next, which are thereby made to revolve without interrupting their sliding or traverse motion.

Upon the axle *a* is the wheel 1, which drives the front roller of the series B by means of the wheel 2. A small wheel upon this roller drives through the intervention of two intermediate wheels, 4, a wheel, 3, upon the back roller. From this back roller the front roller of the other series, A, is driven with equal velocity, by means of intermediate wheels (not represented); motion is communicated to the back roller A in the same manner as at B. The middle rollers of both sets are moved by wheels 5 and 6, attached to them and their respective front rollers, at the other end of the frame, and intermediate wheels 7 and 8 (*pl.* 17, *fig.* 22).

Upon the front roller shaft of the set B, behind the wheel 2 (*fig.* 23), is a bevel pinion, which engages a bevel wheel, 9, upon an inclined shaft, which, by means of other bevel gearing seen at 10, drives the bobbin-roller D. Upon the other end of this shaft is a roller, *x*, from which a band passes to the pulley *y* and drives the axle *z*.

This axle operates by means of a bevel wheel, *a′*, upon two bevel wheels, *b′* and *c′*, which drive the axle *d* in one direction or the other, according as *a′* is shifted in gear with *b′* or *c′*.

This shifting is effected by moving the bar *l′* (*pl.* 18, *fig.* 1), in which is the end-bearing of the shaft *z*, a little one way or the other, and locking it in that position by one of the catches, *m* or *n′*, which fall into notches in the bar *l′*; this bar is moved by one of two weights, *d* and *p*, hung upon a chain running upon rollers, seen in dotted lines (*pl.* 17, *fig.* 23). This chain is attached at its centre and midway between the two weights to a pin secured to the bar *l′*, in such a manner that when one of the weights is raised, the other by its weight moves the bar *l′*.

The two ends of the chain pass down through holes in a balance lever, *v*, over each of which holes there is a small ball upon the chain, against one of which the balance lever *v′* presses alternately to raise that particular weight,

whilst one of the catch-hooks, *m* or *n′* (*pl.* 18, *fig.* 1), is lifted from the notch in the bar *l′*, permitting the other weight to move the rod in the opposite direction, and the bevel gear *a′* to engage with the other of the two wheels *b′* or *c′*.

Upon the shaft is an endless screw, *c′*, which works in a horizontal wheel, *f′*, by means of which and a small pinion upon the upper end of the shaft carrying *f′*, the rack, *h′*, is moved (*pl.* 17, *fig.* 23, and *pl.* 18, *fig.* 1). This rack is connected by means of the rod *i′* with the apparatus H, for the purpose of shortening the traverse motion of the beam *i*, and thus forming the tapering ends of the bobbins; the rack *h′* is also connected with the bell crank lever *t′*, which has at the sides of its upright branch two screws, for the purpose of alternately raising the catch-hooks *m* and *n′* whenever the lever *t′* arrives at one end of its traverse motion. In *fig.* 1 is seen the manner in which this is effected. The other end of the bent lever *t′* raises or depresses one end of the balance-beam *v′* at the end of each traverse motion, and thus stops the action of one of the weights *d* and *p*, whilst the other is drawing the bar *l′*, so that the catch *m* or *n′* not previously raised by the screw *u′*, falls into the notch in the bar *l′*, holding the wheel *a′* in gear, until the bent lever *t′* at the other end of the traverse motion raises this catch and suspends the other weight. We can thus perceive how the rod *i′* is regularly moved to the right and left, and have only now to show how this motion is constantly shortened, and communicated to the beam *i*; *a″* is a curved arm, vibrating upon a centre *b″*, its other end being attached to the rod *i′* (*pl.* 18, *fig.* 1). During the working of the machine, a toothed plate *c″* slides downwards, in the teeth of which and upon opposite sides two clicks engage, *d″ d″*, which are connected together and kept in contact with the rack-plate *c″* by a spiral spring. When the arm *a″*, moved by the rod *i′*, has reached the end of its traverse motion, it presses one of the clicks against the head of the set screw *e″*, which raises the click out of the tooth of the sliding piece *c″*, and permits it to fall the distance of half a foot, the other click *e″* immediately catching it. Thus as the extremity of the lever *g″* constantly approaches the centre of oscillation *b″*, the traverse motion communicated by the rod *g″* to the beam *i* becomes shorter, the arm *a″* vibrating always through equal spaces. The teeth upon the sliding-rod *c″* are cut at alternate intervals on either side, so that its motion at each time is limited to half a tooth. *h″* is a guide screwed to one of the posts G to guide the rod *i″* connected with the rod *g″*; *i″* is joined to a slotted arm *k″* upon the beam *i*, on which the tube-carriers, *k*, stand, as explained above. At each traverse motion of the arm *a″* a pin, *b″*, projecting from the bent piece, strikes against a lever, *m″*, the end of which is seen in *pl.* 17, *fig.* 22, and which, through the lever *n″* and click *o″*, moves the ratchet-wheel I upon the same shaft as the pinion *g* (*pl.* 18, *fig.* 3) one tooth, whilst another click, *p″*, prevents the ratchet-wheel from being forced back by the weight of the beam, *i*, which gradually rises as the spools enlarge. When the toothed rack *c″* has reached its lowest point, a projection upon its side, not seen in the drawings, strikes against the end of the lever *m″*, which sets free a catch at its other end, which makes the upright lever *t″* move the

horizontal lever u''. The latter extends the whole length of the machine, and carries a fork, which shifts the driving-band from the fast to the loose pulley, and thus the machine is stopped. By pushing this rod the attendant is enabled to stop the machine at whichever end he may happen to be.

4. Completion of the Rovings.

After the cotton has passed through one or two bobbin-and-fly frames, or through the tube frame, the rovings are handed over to the *mule* or *throstle*, and spun into yarn. In the finer qualities of yarn the roving is subjected to a process called stretching, in order still further to attenuate it; this is done upon the bobbin-and-fly frame. The machine heretofore employed for this purpose is called a stretching-frame, and differs but little from a mule-jenny. Its operation is briefly as follows: The bobbins filled by the foregoing operations are placed in the frame, and the ends passed through the back drawing rollers, and thence to the front ones, from which they pass out in a lengthened and fine-drawn state, proportional to the amount of drawing which they receive. The rovings thus attenuated are severally attached to the spindles of the carriage; the machine is set in motion; the rovings pass from the front rollers, and the carriage recedes from the stationary part of the machine with a velocity equal to that with which the roving is given out by the drawing rollers. Thus the roving is kept extended between the spindles and the forward drawing rollers. Whilst the carriage is drawn back, the rovings are twisted by the rotation of the spindles, and when it has receded about 54 inches it stops, together with the drawing rollers. The twist is produced without the help of the flyer (of the fly-frame), by the rovings being coiled diagonally up to the point of the spindle, where, from the inclined position of the latter towards the rollers, one end of the roving remains during the revolution of the spindle, and thus receives its twist. The carriage and spindles stop together; it then becomes the business of the attendant to wind up the 54 inches, which she accomplishes by depressing the faller wire with her left hand, so as to bring the rovings at right angles with their respective spindles. At this juncture she turns the spindles by means of a crank with her right hand, whilst she pushes the carriage back to the drawing rollers with a velocity corresponding to that with which she winds up the roving. As the carriage approaches the drawing rollers she raises slowly the faller wire, during the last turn of the spindles; and then the rovings, in consequence of the relative position of the spindles and rollers, coil themselves again to the point of the spindle, and the twisting commences again with another length of roving.

The roving is wound in an oval form upon the spindle, and when the *cop* is sufficiently large it is taken off, *skewered*, and placed in the *creel* of the spinning machine.

The product of the stretching frame is a very soft and delicate roving, and must be handled with great care.

Besides the mule frame, the throstle frame is also used in the preparation

of rovings. It differs from the former in this, that it spins and winds simultaneously: it is, however, used only for the coarser kinds of yarn. The yarn spun upon the two machines is very different; that from the throstle frame is hard and wiry, while that from the mule frame is soft and woolly. The former is used for the warp of heavy goods, for the filling of coarse goods, and also for both warp and filling of fine goods. The object of the throstle frame is to extend the rovings into slender threads, and at the same time to twist them. It consists of two roller beams, each provided with the usual three-fold set of drawing rollers. The fluted rollers receive the roving from the spools, which are placed upon vertical *skewers* fixed in shelves in the middle of the frames, called *creels*. A throstle frame has seldom less than 72 spindles.

Pl. 18, *fig.* 2, is a view of a portion of the front of Danforth's throstle frame; *fig.* 7, an end view; *pl.* 17, *fig.* 24, is a section through the spinning parts of the machine, and *fig.* 22 *a* is a peculiar spindle for winding on cops. A B (*pl.* 18, *fig.* 2) are the usual fast and loose pulleys, the former making about 480 revolutions per minute. Next to the pulley, B, and upon the same shaft, is a pinion which drives the cog-wheel, C; and a pinion, D, upon the same shaft with the latter, drives the wheels, G G (*pl.* 18, *fig.* 7), through the intermediate wheels, E and F. The wheels, G G, drive the drawing rollers, H H, on both sides of the machine. These drawing rollers are arranged as in the other machines already described, the upper ones being pressed upon the lower by weights, K (*pl.* 17, *fig.* 24). The fluted rollers are set in motion by wheels and run with different velocities, the front rollers making about 120 revolutions in a minute, the middle ones about 17, and the back rollers 12. Their relative velocities are capable of regulation by the change of the intermediate wheels. In this manner the roving, I, is drawn out proportionally to the relative velocities of the front and back rollers.

The twisting is effected as follows: *a* (*pl.* 17, *fig.* 24) are the spindles secured to the rail, *m*, by a screw; *b* is a small pulley, with a hollow axle, running freely on the spindle, *a*. The pulley, *b*, is driven by a band from the drum, L (*pl.* 18, *fig.* 2). The band runs first round two spindles on one side of the machine, and then round two upon the other side, and lastly round the tightening pulley, M, back to the drum. In this manner four pulleys are driven and four threads are spun. Upon the pulley, *b*, and over the said tube, the bobbin is placed, on which the thread is wound after being twisted by the revolution of the pulley, *b*. The winding is effected by a hollow cylinder fast to the immovable spindle. The thread is forced to pass below the lower edge of this cylinder to the bobbin, which is revolved by friction upon the pulley, *b*, and winds up the thread as fast as it comes from the rollers. This winding up would be very imperfectly performed, were not an up and down motion imparted to either the bobbin or the cylinder, in order to fill the bobbin evenly. It has been found preferable to give this up and down motion to the bobbin. The small whorls which carry the bobbins slide freely up and down the spindles, and rest upon a bar, *f*, called the copping rail, which is raised and lowered by means

of the levers, *o*, *o* (*fig.* 7). These levers receive their motion from the heart-formed cam, P, upon a shaft with the wheel, R, which is driven by a pinion upon the shaft, S, and a worm, T, on the shaft of the wheel, E. The whorls, *b b*, make about 6,000 revolutions in a minute. To prevent the interference of the threads with each other at this great speed, the bobbins are sometimes separated from each other by partitions of tin plate secured to a board back of them.

5. The Mule, and Mule Spinning.

The finer qualities of thread are spun upon the mule. The operation of the machine is in general similar to that of the stretching frame, and may be stated as follows:

The rovings coming from the bobbins in the creel pass between the rollers and the spindles, the carriage in this machine moving somewhat faster than the rollers, and not as in the stretching frame, where they move with equal velocities. This excess of velocity is called the *gain* of the carriage, and has the effect of rendering the thread uniform by drawing out the larger and less twisted portions. When the carriage has advanced 45 or 50 inches, according to the fineness of the work, a general change takes place in the operation of the mule; the drawing rollers stop, the velocity of the spindles is nearly doubled, and the carriage slackens its pace to about one sixth of its former velocity; this part of the operation is called *draw*. When the threads are sufficiently extended the carriage stops, but the spindles continue to revolve until the requisite twist is communicated. The thread is then wound upon the spindles, as the carriage returns to repeat the operation.

Pl. 18, *fig.* 8, is an end view of a self-acting mule, or mule jenny; *fig.* 9, a plan of the head-stock, showing a portion of the drawing-rollers, certain portions of the head-stock being removed, which are shown in *fig.* 10; *fig.* 11 is a cross-section, *fig.* 12 a front view of a portion of the carriage which moves beneath the head-stock; *fig.* 13, the frame opposite to the head-stock; and *figs.* 14 and 15 are detached portions, to which reference will be made.

A A A (*fig.* 8) is a cast-iron frame, to which, on each side of the head-stock, is fixed the roller-beam B, seen in section. C C′ C″ (*figs.* 8 and 10) are three pulleys upon a horizontal shaft, *a*. The pulley C, secured together with the wheel *l* upon a hollow axle, turns freely upon the shaft; C′, on the contrary, is secured to the shaft, and the narrow pulley C″ is the loose pulley.

Two bands, D and D′, drive these pulleys; the first moves the pulleys by covering one half of each, but it is moved at a certain stage of the process upon C alone. At the same time the band D′, running in a contrary direction and with a less velocity, runs for a few seconds on the pulley C′ and immediately returns to the loose pulley C″. The pulley C, which revolves constantly with a uniform velocity, drives the apparatus for changing the

motions, and carries the carriage back to the head-stock when the other motions have all ceased. This apparatus consists of the cam-shaft, *b*, and a friction-pulley, *c*, which has four parallel grooved cavities at equal distances in its circumference, in any one of which the leather-covered pulley *d* (*fig.* 10) may slide, when revolving opposite to the groove; the pulley *d* is moved by a cog-wheel, 2, upon the same axis, which is driven by a cog-wheel, 1, connected with the pulley c. When an edge of any one of the grooves of the pulley *c* by the action of a spring is made to press against the leather-covered pulley *d*, the latter will turn the pulley *c* by friction through a quadrant, till the shaft *b* is arrested by a catch, which prevents the further action of the spring, and makes the pulley *d* run in the concavity of the next groove. By disengaging the catch, the grooved pulley *c* will turn through another quadrant, and so in succession, making four different motions in one complete stretch: 3 is a pinion upon the shaft *a*, which drives, by means of the intermediate wheel 4, the cog-wheel 5 (*fig.* 9), which gives motion by means of the bevel-wheels 6 and 7 to the shaft connecting the front rollers of both sides of the machine. Upon the shaft *f* is also a pinion, 8, which engages with the cog-wheel, 9, on the shaft *g*, carrying a drum, E, which draws the carriage out by means of a rope. The rollers are stopped by moving the bevel-wheel 7 out of gear with 6, uncoupling the wheel 8 with the shaft *f*, and at the same time bringing the small bevel-wheel 10 into gear with the wheel 11, from which the drum E now derives its motion. The wheel 10 is driven by a crossed band from a small pulley, on the shaft with the cog-wheels 5 and 6, to the pulley *l* on the shaft *i;* by which means a slower motion is communicated to the drum E and carriage. From the front roller shaft motion is communicated in the usual manner to the other rollers, the carrier-shaft *n* serving for the rollers on both sides of the machine.

F is a double spiral scroll upon a shaft running in the main frame A; to the smaller radii of the scrolls are attached ropes going round the spirals; these ropes, after making a few turns round the drums E and G, are severally attached thereto. Two other ropes are attached to the barrels E and G, the other ends of which are attached to two small drums of the carriage H (*fig.* 8); the ratchet-wheels seen upon the shafts of these rollers are for the purpose of tightening the ropes as required. The spiral scroll F has nothing to do with the outward motion of the carriage; this is effected by the revolving drum E. When the latter is disengaged by throwing the bevel-wheel 10 out of gear with 11, the carriage stops until it is to be returned, at which juncture the pinion 12 is engaged with the bevel-wheel 13, which thus drives the shaft bearing the scroll F. This now moves the carriage, first with an increasing, and then with a decreasing speed, as it nears the roller-beam; the drawing-out ropes remaining fully stretched, since the scroll gives off as much rope in one direction as it takes up in another. The pinion 12 upon the shaft *q*, which revolves uninterruptedly (although not in gear with 13), is driven by the wheel 14 (*fig.* 10), which receives motion from the intermediate wheel 15 upon the shaft *r*, which also carries the wheel 16 (*figs.* 8 and 10). The wheel 16 gets its motion from the wheel 1, which drives also the friction-pulley *d*.

We will now describe the driving parts of the carriage. S is an inclined shaft (*figs.* 8 and 12), parallel to the axis of rotation of the driving-drums (*fig.* 11), which give motion to the wharves of the spindles. Upon the shaft S is the double grooved pulley I, which gives motion by bands in the usual manner to the drawing-drums on each side of the carriage. On the lower end of the shaft S is a bevel-wheel, 17, which may be shifted to engage with either of the bevel-wheels 18 or 19 (*fig.* 12). The wheel 18 is placed upon a short shaft which carries a double-band pulley, L, driven by a band from the twist-pulley M, passing under guide-pulleys, *t* and *u* (*figs.* 8 and 9). One end of this band passes over the guide-pulley, N, of the carriage, round the driving-pulley L, for the purpose of increasing the friction between the band and pulley, and insuring the rotation of the spindles. The endless band then passes round the horizontal tightening-pulley, V (*fig.* 9), thence back under the other guide-pulley, *t*, and up to the twist-pulley M again.

After the backing off is performed, the shaft S is shifted, so that the bevel-wheel 17 engages the wheel 19 (*fig.* 12), on a short shaft carrying a wheel, 20, which gears into a wheel, 21, upon the shaft of the winding-on barrel *o*, on the periphery of which are grooves to carry the chain attached to it. The other end of this chain is fixed to the point 10 of the apparatus P (*fig.* 8).

As the carriage moves backwards to the roller-beam it causes the drum, *o*, to revolve as the chain pulls it round, the other end of the chain being fast at the point, 10. Thus the shaft S receives a slow motion on its axis through the wheels 21, 20, 19, 17, which, during the return of the carriage, causes the spindles to revolve and wind on the yarn by the depression of the faller. P (*fig.* 8) is a toothed quadrant revolving upon a centre, X, and having a grooved arm, *y*, in front of which is a screw, having on one end a small bevel wheel, 22, which gears with another, 23, turning with a pulley, *z*, on an axis. In the groove of the arm, *y*, slides a nut, 10, to which the end of the chain is attached, and which moves gradually to the end of the screw by the revolution of the pulley, *z*, and consequently the bevel wheels 23 and 22, the latter being fast to the screw, *y*. This quadrant moves through one fourth of a circle during the going out of the carriage, being in gear with the pinion, 24, on the shaft of the barrel, G, round which the rope passes which carries out the carriage. Therefore the scroll, F, moving back the carriage with a varying velocity, gives by the pinion, 24, a corresponding returning motion to the said quadrant, by which means the nut, 10, is caused to describe a quadrant of a circle of a diameter corresponding to the distance of the point, 10, from the centre of the quadrant. By this action the drum, *o*, does not turn in proportion to the advance of the carriage; the point, 10, to which the end of the chain of that drum is attached, following the motion of the carriage in the proportion of the cosines of the arcs through which the quadrant P has turned. The velocity of the drum, *o*, is consequently increased as the said cosines diminish, and therefore turns the spindles faster as the carriage approaches the roller beam, the faller guiding the threads upon the cop.

In the beginning of building the cop the nut, 10, is nearest the centre of the quadrant, P, and may then be considered as a fixed point for the chain, causing therefore the spindles to turn with the carriage during its going in.

During the making of the double cone foundation of the cop (*pl.* 18, *fig.* 16), the nut, 10, is moved gradually towards the extremity of the arm, *y*, thus describing increasing arcs, and thereby causing the spindles to turn at each stretch more slowly at the beginning, and more quickly towards the end of the winding-on; the faller beginning the winding-on each time at a higher point of the spindle.

When the double cone is made, the winding-on guided by the quadrant, P, remains constant, as the nut, 10, does not move any more, while the faller after each stretch continues to lay on the winding from a higher point of the spindle. The motion to the screw, *y*, is given at each stretch in the following manner. Over the small pulley, *z* (*fig.* 8), and over the guide-pulley *a'*, runs an endless band, a certain length of which is moved during the return of the carriage in forming the double cone foundation of the cop. *b* is a lever connected with the faller arm, *c'*, by a chain, and which, when the faller sinks, presses upon the said band and pinches it to the plate, *d'* (*fig.* 11), whereby it is fixed by the returning carriage and drawn along with it till the faller rises again and lifts the weight of the pinching lever, *b*, from the plate.

After the double cone is made, the faller no longer descends so low as to permit the lever, *b*, to press upon the band, and the nut, 10, is no further moved outwards; thenceforth the cop continues to be built by winding on uniform surfaces of yarn upon the top cone of the foundation (*fig.* 16); the faller at each stretch descending less and less, and consequently beginning the winding-on at successively higher points (*fig.* 16).

On the carriage (*figs.* 11 and 12) are two shafts, *e* and *f*, running its whole length, the former being the faller-shaft, and the latter the counter-faller-shaft, which latter is here put in front of the carriage.

On either side of the carriage both are moved by small arms attached to them, and by connecting-rods joined to arms, *t* and *k*, on the ends of horizontal shafts, *l' m'*. The faller-shaft, *e*, is always kept up by several spiral springs working on arms attached to it, unless when depressed during the winding-on action of the machine. On the counter-faller-shaft, *f*, are several segments from which by chains are suspended weights, *n'*, which are directly proportional to the number of the threads, and inversely proportional to the fineness of the yarn, and which serve to support the threads during their winding on the spindles. The faller-shafts on each side of the machine are depressed and raised in the following way. On the shaft belonging to the left side of the carriage is fixed a small pinion, *o'*, which is in gear with the toothed segment, *p'*, the shaft of which rests in bearings on the carriage (*figs.* 8, 14, and 15). The toothed segment, *p'*, has one portion smooth, at whose end is a notch, *q'*, into which by turning the segment, which is loose on its shaft, a catch, *r'*, may fall. This catch is fixed upon a curved arm, *s'*, which embraces the shaft of the segment, and is thus permitted to move up and down with the catch, *r'*. Another curved

arm, r, turns loosely round the shaft of the segment, and is connected by a link to the arm, s', and has at its end a roller, u', which slides during the motions of the carriage on a long rail, Q, fixed to the frame of the head-stock (*fig.* 13) on the side opposite to that represented in *fig.* 8.

In *fig.* 13 this frame is shown with the rail, Q, in dotted lines behind; this rail has two pins, a'' and b'', going through the slots in the frame-piece, B, which rest upon two plates, c'' and d'', called the shaper plates, because they define the shape of the cops, and are connected with each other by the bar e''. The shaper plate, d'', has a nut, f'', in which a screw works, bearing on its end a ratchet-wheel, g'', one or two teeth of which are moved by a click from the carriage at the end of each of its comings-out. Thus the shaper plates c'' and d'' are gradually shifted, and the rail, Q, at the back of the frame-piece, B (*figs.* 14 and 15), is permitted to sink a little so as to make the roller u' (*fig.* 14) run lower upon its rail, Q, during the motions of the carriage. When the faller is depressed, which is at the time when the carriage begins its going-in, the segment, p', is turned, and the catch, r', falling into the notch, q', must now follow the action of the sliding roller, u', on the rail Q. The segment, p', now driving o', which is attached to the faller-shaft of the left side of the carriage, will give to that shaft a regular rising motion in proportion as the carriage approaches the roller beam, by being connected to the roller u', which runs over the inclined rail Q. The carriage having reached the end of its course, the arm s' goes over the bar v seen in section in *fig.* 15, by which means the catch r' is lifted from its notch q' (*fig.* 14), and the fallers are made to rise by the spiral springs attached to them: the same motion is transferred to the faller-shaft, e' (*fig.* 15), on the right hand side of the carriage by the horizontal shaft l', to which both are connected by arms and connecting-rods.

We have now to explain how all these motions are successively produced in the machine. b (*fig.* 8) is the shaft which by certain disengagements is permitted to revolve at each of four different periods through a fourth part of a circle. On this shaft are the following guides and eccentrics. In front of the pulleys, C, C', C'', is the guide, h'' (*fig.* 10), for the fork of the strap, D, which is attached to the top end of the lever; i'', the guide (l'' in *fig.* 10) for the other strap, D', which is shifted by the lever, k, working in the bar, l'', on the end of which is fixed the fork for the said strap. m'' (*fig.* 8) is an eccentric by which the bevel wheel, 7, and the coupling clutch on the shaft, f (*fig.* 9), is worked, whilst the wheel 10 is brought into gear with 11. The lever which carries the bearing of the shaft i and shift-wheel 10 into gear with 11 is connected with the lever n'' (*fig.* 8), working the coupling on the shaft f (*fig.* 9), and is moved by the eccentric m'' by a hook, which being subsequently lifted makes also the wheel 10 to fall out of gear with 11. o'' is a finger, seen best in *fig.* 10, by which the quantity of twist is regulated, and which keeps the shaft b from turning a fourth part of a revolution till a notch in the plate p allows that finger to strike through. The shaft is afterwards arrested in another way.

The plate p is fixed on a shaft with wheel 25 (*fig.* 8), which is driven by a worm on the principal shaft, a (*fig.* 10), and may be varied in diameter

according to the quantity of twist the yarn is to have. q'' is another eccentric, by which the wheel 12 is shifted into gear with 13 by means of the bell-crank lever r'', at the end of which is the bearing of the shaft q. s'' is a plate on the shaft b (*fig.* 10), having on one end four pins, against which a spring presses so as to bring the friction-pulley, c, in contact with the pulley d, thus to make it turn through a quadrant. On the other side of the said plate s'' are three square escapement pieces, against which presses the end of a rod, u'', connected with the end of the horizontal balance lever S. By either depressing or lifting this lever the rod, u'', is moved from one of the catches on the plate s'', by which it revolves through a quadrant, as has been said, and is then caught by the next escapement on the plate s''.

In the going-out of the carriage let us suppose the band D to be driving both the pulleys, C and C′, and the strap D′ to be on the loose pulley C′. The rollers are driven by the shaft e', and the carriage moved by the drum E, getting motion by the wheels 8 and 9 (*fig.* 9). The twist is given from the pulley M driving the pulley L, and the bevel wheel 18, which engages with the wheel 17 upon the shaft S. The carriage coming near the end of its course lifts a catch from a latch (see dotted lines in *fig.* 8) of the lever S′, which sinks a little and is caught by a second catch, which is connected by a rod, V″, to a lever, T, the latter resting on the boss of the curved arm s' (*figs.* 14 and 15). By the falling of the left hand end of the balance-lever, S′, the rod u'' has moved from one of the escapements of the plate s'' (*fig.* 10), and after the shaft b has made a quadrantal motion, it is arrested by the finger o'' striking against the plate p; by this means the eccentric m'', on the shaft b, has disconnected the coupling on the shaft f (*fig.* 9). The rollers are thus set at rest, while the carriage moves a little longer, but very slowly, being driven by the shaft i and the wheels 10 and 11 (*fig.* 9). The carriage, having arrived at the end of its course, strikes against a rod not seen in the figures, detaching the click, with which, by the lever n'', the wheel 10 was shifted into gear with 11, thus setting at rest those parts which gave motion to the carriage. The twisting motion, however, is continued till the principal shaft, a, has turned the wheel 25 so far round that the finger o'' can strike through the notch in the plate p (*fig.* 8). The shaft b goes on to revolve through a second quadrant, and is now caught by the rod u'' at one of the catches of the plate s''. By this quadrantal motion the straps are shifted, D moves to the pulley C, alone, and D′, which moves much slower, and in an opposite direction, is shifted to the pulley C, which is fixed on the shaft of the twist-pulley M. The latter is therefore now turning in the contrary direction, and giving a like motion to the spindles, thus backing off the coils of the yarn from the noses of the spindles. At the same time, however, a ratchet-wheel, w (*fig.* 8), on the slant-shaft S of the carriage, turns by a click, x'', a plate connected with a spiral piece below, to which is attached the end of a chain which passes over two guide-pulleys, z'' and R″, to an arm, a''', at the top of the carriage, upon the same shaft with the pinion b.

By the reverse motion of the shaft S, therefore, the faller is depressed till

the catch r' falls into the notch q' of the segment p', after which the faller follows the motion given to the roller u' by its sliding on the rail Q. At the time, however, that the catch falls into the notch, the lever T, which had been resting upon the boss of the curved arm s' (*figs.* 8 and 15), falls also, and takes away the catch which had suspended the latch of the left hand end of the balance-lever S′, and makes this end to fall a second time, after which the rod u'' lets another detent of plate s'' escape, and causes the shaft b to revolve through the third quadrant, by which the straps D and D′ are brought back to their former positions. Meanwhile the shaft S is shifted with its wheel 17 into gear with 19, as will presently be described, and the eccentric q'' (*fig.* 8) has shifted the wheel 12 into gear with 13, which is fixed on a shaft with the scroll F, by which the carriage is now returned towards the roller-beam, whilst the winding-on is performed by the drum o (*fig.* 12), turned by the chain attached to the nut 10 at the quadrant P (*fig.* 8). Round this drum there are a few coils of a rope, which passes over the two pulleys b''' and c''' (*fig.* 8), and suspends a weight, d''', in order to keep the chain tight upon the drum o.

When the carriage comes home to its place, near the roller-beam, it presses down the right hand end of the balance-beam S, and makes the rod u'' to fall off from the third escapement of the plate s'', after which the shaft b turns through the fourth quadrant.

By this motion the eccentric q'' shifts the wheel 12 out of gear with 13, while the eccentric m'' sets the rollers in gear by the coupling upon the shaft f, and of course, also, the drum E which moves out the carriage by the wheels 8 and 9. The bar r (*fig.* 14) has now lifted the catch r', out of the notch q' in the segment p', and thus has disengaged the faller shaft; finally, the shaft S (*fig.* 12) is shifted together with its wheel, 17, to give twist again to the yarn spun during the next stretch of the carriage. It remains only to mention how this shifting of the shaft, S, is performed, at the moment of the carriage going in and out. The step-bearing of the said shaft is fixed on the end of a bell-crank lever, e''' (*fig.* 8), the other end of which is connected with an arm upon a shaft upon which is a kind of balance lever, h''' and i''', which passes, when the carriage arrives at each end of its course, under rollers attached to the large radial weights U at each end of the frame, which thus presses on that one of the arms h''' or i''', which is just arrested by a detent or click, and keeps the wheel 17 in gear with either 18 or 19. When the carriage is drawn out, and the wheel 17 is still in gear with 18, the arm h''' is suspended, and remains so, till by the falling of the lever T, the balance lever S′ makes its second fall, and disengages the click by which the arm, h''', is suspended; the latter is now depressed by the radial weight U, whilst the other arm, i''', is caught by another click. On the contrary, when the carriage arrives near the roller-beam at the same time that it depresses the balance-beam S, and changes the motion, the click which keeps the arm, i'', suspended is also disengaged, and the radial weight on the right hand of the machine (*fig.* 8) presses down the arm i''', whilst h''' is caught in its click, and keeps the wheel 17 in gear with wheel 18. k''' is a detent or click, in which an arm,

connected with the counter-faller shaft, is caught when the carriage is going out. This arm has on its end a roller, which glides at the beginning of the course of the carriage over an inclined plane, x, fixed on the floor (*fig.* 11), and lifts the arm to be laid hold of by the catch k'''. When, however, the faller becomes depressed at the going-in of the carriage, the finger, t''', is attached to the arm t (*fig.* 11), near the left hand wheel, disengages the arm attached to the counter-faller from its catch k''', and causes the counter-faller to react against the tension of the threads.

The yarn is now reeled and bound in hanks. It is numbered according to its fineness, the number expressing the weight of a certain fixed length of thread. *Figs.* 22 and 23 represent the scales commonly made use of for weighing yarn; *fig.* 24 illustrates its operation. The assorted yarn is then packed for transportation in a press of simple construction, seen in *figs.* 27, 28, and 29.

6. The Singing or Gassing of Yarn.

The fine cotton yarn used in the manufacture of bobbin-net lace, and for hosiery, is generally subjected to a singing process, to free it from loose fibres, which operation gives it a more uniform, compact appearance. This singing is accomplished in a peculiar machine by passing the threads with great rapidity through the flame of gas. *Pl.* 19, *figs.* 16, 17, and 18, are different views of a gassing machine of simple construction, the general operation of which is apparent from inspection. *Fig.* 19 is the heart-cam serving to guide the thread upon the winding-on bobbin. The thread passes from the bobbins I round the glass pins p and the rollers q and q', between which rollers it is subjected to the action of the flame; thence it passes through the guide-plate, r, to the winding-on bobbins, G, which are revolved by friction upon the rotating carrier pulleys, F. The bobbins make from 2500 to 3500 revolutions per minute.

7. Weaving.

The preparatory step to weaving is arranging the warp-yarn in parallel layers upon a wooden beam. This is effected by the aid of an ingenious machine called the warping-mill. *Pl.* 19, *fig.* 2, is an end view, and *fig.* 3 a plan of a warping-mill of approved construction. The threads pass from the bobbins A through guides a and d round rollers C C′ C″, and are ultimately wound upon the warp beam G, which runs in vertical slots in the arms f, and is revolved by friction upon a cloth-covered roller, I.

For the purpose of showing the threads more plainly, the machine is painted black, and when the warper discovers a thread to be missing, she stops the machine, finds the ends and unites them, and the machine runs on again. *Pl.* 19, *fig.* 20, shows the arrangement of the spools in *fig* 3.

Pl. 19, *fig.* 1, shows the ordinary method of beaming for hand-weaving.

The spools are placed upon a frame, E, and the threads pass through the guide F, which descends as the reel is turned. This is effected by the attendant by means of a crank, pulleys, cord, &c.

Weaving proper is the art of making cloth by the rectangular decussation of flexible fibres, of which the longitudinal are called the *warp* or chain, and the traverse the *woof* or weft. The former extends through the whole length of the web, the latter only over its breadth. The outside thread on each side of the warp, round which the filling or woof thread returns, in the act of decussation, is called the *selvage* or list.

Pl. 19, *fig.* 4, exhibits the old European loom in its simplest form. The chain is wound upon the *warp-beam*, A, and passes thence through the *heddles*, C, which consist of twines looped in the middle, one half of the warp threads passing through the loops in each heddle. The yarns then pass through the reed beneath D at the bottom of the swinging frame E, called the *batten lay* or *lathe.* The weaver, seated upon the bench G, alternately raises and depresses the heddles C by pressing his foot upon one or other of the treddles, H, which are connected by cords to the bottom of the heddles. By this motion of the heddles, one half of the warp threads are carried up and the other half down, a few inches, thus *shedding* the warp, as it is technically termed, for the passage of the shuttle, which carries through the warp thread or filling. The shuttle is thrown through the shed by a sharp jerk given to the *picking-strings*, seen at I, by the hand of the operative, and leaves a *shoot* of weft behind it. The weaver then swings the batten E towards him, to *beat up* the thread thus laid in, and the heddles are changed again by the treddles, preparatory to passing the shuttle again through the shed. In more primitive looms the shuttle was passed through the shed by hand. The cloth is wound up as fast as woven, upon the *cloth beam* at I.

The power-loom has experienced many changes and improvements since its first introduction. In *pl.* 19, *figs.* 5, 6, and 7, is represented a power-loom of modern approved construction.

A is the frame of the loom, B fast and loose pulleys, upon the *crank shaft.* Upon the other end of the crank shaft is a cog-wheel D, driving a wheel D′, with double the number of teeth, upon the shaft E, which makes, therefore, only half as many revolutions as the crank shaft B. The shaft, E, is called the *wiper*, or *comb-shaft;* it throws the shuttle, and raises and lowers the heddles, while the shaft B by means of its crank F works the lay H, which drives home the weft towards the finished cloth. The cranks F are connected with the two levers G, called the *swords* of the lay, to which the batten H is made fast, which carries the reed in its middle, and the shuttle-boxes *h* at its ends. I is the warp-beam; the warp yarns pass from it, over the roller K, through the heddles L and reed *l′*, over the breast beam M (having now been woven into cloth), and are finally wound upon the roller N, or cloth beam. This roller bears at one end a toothed wheel *a*, moved slowly by a small pinion *u*, upon the axis of the ratchet-wheel *b* (*fig.* 7). This latter wheel is turned round a little after every *throw* of the shuttle, or shoot of the weft, by means of a stud projecting from one of the swords of the lay. The lifting of the heddles, L, is performed by two eccentric wipers O O′, upon the shaft E,

which press the treddle levers P and P′, alternately up and down. These levers are connected by strings or wires with their respective heddles, which are in their turn placed in communication by straps, which play over rollers, *e*, at the top of the loom.

Pl. 19, *fig.* 21, shows these levers isolated. The shuttle is thrown by the two levers, Q Q, which are alternately moved with a jerk by the rollers, R, secured to the shaft, E, by means of arms, and working upon cams, S, connected with the shafts of the arms, Q Q. These arms are connected together at the bottom by a cord or strap, mounted with a spring of spiral wire.

The shuttle is lodged in one of the boxes, *f f*, of the batten, H, and is driven across along its *shed-way* by one of the pickers, *g g*, which run on the two parallel guide wires, *h h*, and are connected with the arms, Q, by strong cords.

If by any accident the shuttle should stick in the shed-way, the blows of the batten, H, against it would cause the warp to be torn to pieces. In order to guard against this, a contrivance has been introduced for stopping the loom immediately, in case the shuttle should not come home into its cell. Under the batten H (*pl.* 19, *figs.* 7 and 22) there is a small shaft, *i*, on each side of which a lever, *l* and *l′* (*fig.* 6), is fixed; these two levers are pressed by springs against other levers, *m m*, which enter partly into the shuttle-boxes. There they act as brakes to soften the impulse of the shuttle, and allow also the point of the lever *l* to fall downwards into a line with the prominence at *n*, provided the shuttles do not enter in and press the spring-point, *m*, backwards, together with the upright arm *l′*, and thus raise the horizontal arm *l* above *n*. When this does not take place, that is, when the shuttle has not gone fairly home, the lever *l* hangs down, strikes against the obstacle *n*, moves this piece forwards so as to press against the spring lever or trigger *o o*, which leaps from its catch or detent, shifts the fork *p p* with its strap from the fast to the loose pulley, and thus in an instant arrests every motion of the machine.

The shuttle is represented in *fig.* 8 in a top view and in *fig.* 9 in a side view. It is made of a piece of box-wood mortised out in the middle and tapered off at its ends, the tips being shod with iron points to protect them from injury by blows against the guides and the bottoms of the boxes.

In the hollow part, *a b*, there is a skewer or spindle, *c*, seen in dotted lines. One end of this skewer turns about the axis, *d*, to allow it to come out of the mortise when the cop is put on.

e (see dotted lines in *fig.* 9) is the spring which keeps the spindle *c* in its place by pressing against one of the sides of the square ends of the spindle. *f* is a projecting pin or little stud, against which the spindle *c* bears when laid in its place. *g* is a hole in one side of the shuttle, bushed with ivory, through which the thread passes, after being drawn through a slit in the centre of a brass plate, *h*. In that side of the shuttle which is furnished with the eye-hole there is a groove extending its whole length for receiving the thread as it unwinds from the cop.

The warp is wound upon the cylinder I, and passes over the roller K; the cloth is formed at the point *r*, passes over the breast-beam M, and is wound

upon the cloth-beam N. The delivery of the yarn is regulated, and the warp threads are kept at a uniform tension, by friction produced by a cord with weights attached to it passing round the beam I.

The cloth-roller N bears upon one of its iron axes prolonged, the toothed-wheel, *a*, which works into a pinion, *u* (seen in dotted lines, *fig.* 7), upon the axis of the ratchet-wheel *b*. Hence if the latter be turned gradually by the motion of the lay, as before explained, the cloth-beam N will be revolved very slowly, and thus take up the woven cloth.

The heddles, through the loops of which the warp threads pass (one half through each), are connected together by straps, passing over pulleys, *e*, at the top of the machine in such a manner as to balance each other, the descent of one drawing the other up. At the bottom they are connected to two bars, U and V, which are secured by rods, *o o'*, to two treddles, P P'', turning on a pivot at W. These treddles are alternately depressed by the cams O O'' upon the revolving shaft E, and thus the heddles are alternately raised and depressed, and the warp threads opened to form the shed or angular opening between the threads seen at *r* (*fig.* 6), through which the shuttle passes to carry the woof thread.

Pl. 19, *figs.* 10 and 11, represent the *jaw-temples*, which serve to keep the cloth distended to its full width during the operation of weaving; these temples are attached one on each side of the loom, and consist of spring pincers, which seize the selvage of the cloth immediately in front of the point where it is woven. At each beat of the lay the movable jaw of the temple is opened to permit the cloth to pass the small amount made by the one thread, beat up, and the instant the lay recedes the jaws grip the cloth again, and hold it distended until the lay beats up again.

8. Finishing and Bleaching.

The first operation in the finishing of cotton goods is bleaching, which is not so tedious as with linen, as the cotton is but slightly colored. The size, which was put upon the chain threads before weaving, is first soaked off in warm water, in which the cotton is allowed to remain thirty-six or forty-eight hours, or until a sort of fermentation takes place; it is then washed in running water, and bleached either by exposure to the sun or with chlorine.

The cotton is first singed by passing it quickly over the surface of a red-hot iron, to free the surface from loose fibres. *Pl.* 19, *figs.* 12 and 13, represent the singing-oven: *a* is the oven door; *b*, the fire-grate; *c*, the ash-pit; *d*, the flue. In light goods, muslins, &c., the flame of alcohol or of gas is sometimes used. The cotton then goes to the wash-wheel, represented in plan in *pl.* 19, *fig.* 15; *fig.* 14 *a* is a portion of the front side, and *fig.* 14 *b* a view of a portion of the back of the wheel. This wheel makes about twenty revolutions per minute. A constant stream of clear water is admitted through a tube at *i*, the dirty water passing off through holes in the case *h*; *f* are openings to admit the goods; *m* is a cog-wheel by which

the wheel is driven. The goods are then boiled to free them entirely from size and to open the pores.

Pl. 18, *figs.* 17, 18, and 19, represent a washing-kettle of common construction, the upper part, A, of which is for the reception of the goods, and the lower, L, for the water; C is a grating, seen also in *fig.* 19, from the central hole of which rises the tube D. F is the fire-chamber, the grating of which is seen in *fig.* 18. In this kettle the goods are boiled ten hours, being closely watched, as the water should constantly rise through the tube D and pass down through the goods.

Then follows the *bucking* or boiling in a lye of potash, which is thrice repeated, the goods being washed after each operation, and ultimately passed through the wringing-machine (*pl.* 18, *figs.* 20 and 21), consisting of rollers in a strong frame, between which the cotton is passed under heavy pressure, and thus the water is pressed out. Then follows the treatment with chloride of lime, and finally the *sour* bath, the acid of which acting upon the chloride gradually and slowly sets free the chlorine in immediate contact with the cotton.

The goods then pass to the starching and steam-drying apparatus (*pl.* 18, *figs.* 25 and 26), being carried from the roller Q beneath a roller, I, which carries it through the paste-trough, E; it then passes over the hollow cylinders, L, heated by steam, admitted through the tubes, O, from the steam-pipe, N. Ultimately the finished cotton passes out between the rollers, T, and is folded upon the table, U.

We close our observations on cotton manufacture with a few cursory remarks on the kindred manufacture of woollen goods.

Woollen Manufacture.

Nearly all the wool manufactured in Europe and the United States is that of the sheep. The first operation to which it is subjected is washing with soap and water, to free it from sweat, grease, and dust; it is then passed through the drying squeezers, and carried to the drying-room over the boilers of the steam-engine. The wool is then passed through a machine differing somewhat from the willow used in the cotton manufacture, and represented in *pl.* 18, *figs.* 30–33. It consists of a series of rapidly revolving fans upon a shaft, H (*fig.* 33), within a net-work of wire, the whole inclosed within a tight wooden case, A B. The wool is fed to the machine upon the feeding apron, D, running upon rollers, E and G, passes between fluted rollers, and is caught by the teeth, N, of the revolving fans; and as it is carried round is beaten against the wire net-work, separated and opened by the teeth, O, upon the interior of the wire cylinder, and ultimately thrown out at one end of the machine, opened and free from the dust, which has passed through the wire cylinder. After being cleaned in this manner, the wool is again oiled and passed through a wolf of simpler construction, then carded upon machines not essentially different from those already described under Cotton Manufacture, spun, and woven.

VI. COINING.

COINING is the art of making the metallic currency of trade. In civilized countries the currency is partly metallic, partly of paper; the latter having an imaginary value, based upon the credit of him who issues it.

1. METALLIC MONEY.

Gold and silver, the most precious metals, have been used from the earliest periods as the materials for the fabrication of money. Platina has also been resorted to in more modern times, but its value is too fluctuating for a steady currency, and its use has been abandoned. Besides these metals an alloy of silver and copper, and also pure copper, are in use for coins of the lowest denominations, on account of the diminutive size of silver coins of so small a value.

Coins are almost always made in the form of small round plates or disks, on one side of which, called the *obverse*, is the head of the sovereign, the arms of the state, or an emblematic device; and upon the other, called the *reverse*, a suitable expression of its value. As, for various reasons, gold and silver are never coined pure, but with an alloy of copper, the proportions in which the noble metals and copper are used must be accurately prescribed. Almost every state has its own standard. In Germany this is determined by the number of sixteenths of pure silver which a crude alloyed mark shall contain, and the number of coins to be struck from the same. For gold coins, in the same manner, it is fixed how many twenty-fourth parts, or *carats*, of fine gold they are to contain, and how many pieces of coin shall be struck from a given weight of the alloy. Though the just weight and proper alloy are thus fixed for every kind of coin, yet the rule cannot be applied with mathematical precision; a slight variation must therefore be allowed from the regulation. This variation is termed the *remedium*, or the authority to the mint to diminish the alloy. Formerly this was more considerable than it is in the present advanced state of the art of coining. In France it is $\frac{1}{2000}$ above or below the fixed rate for gold, and for silver $\frac{1}{1000}$ for five-franc pieces, $\frac{5}{1000}$ for two-franc pieces, and $\frac{10}{1000}$ for quarter francs.

The value of coined silver is of course somewhat higher than that of uncoined, as those fabricating the coin must be remunerated for their labor. This increase of value is termed the mint tax. In France, where the coinage is most excellent, the mint now reckons coined gold only at about $\frac{1}{3}$ per cent., and coined silver only about $1\frac{1}{2}$ per cent. over the uncoined. The minting of the baser metals is much more expensive than that of gold and silver, as it costs more to coin one hundred cents than one dollar.

1. MELTING. The melting of gold and silver is generally carried on in large black-lead or cast-iron crucibles in cupola furnaces, with charcoal or coke.

The crucible is first heated before the alloyed metal is put in, that any cracks may become apparent; and the metal is covered with a layer of charcoal, to prevent oxidation by exposure to the air. After it is thoroughly melted a specimen is taken out, the alloy tested, and, if necessary, rectified. If the proof is satisfactory, the metal is cast into *ingots*, in moulds of cast or wrought iron. Silver is taken out of the crucible with an iron ladle coated with clay; gold is manipulated with a black-lead crucible held by tongs. In England and the United States the cast-iron crucible is raised from the furnace by the aid of a crane, and set into a peculiar pouring machine, which is gradually tilted by a curved rack and pinion, to allow the contents to flow into the iron forms. *Pl.* 20, *figs.* 1 and 2, exhibit such a machine. As the crucible is tilted, the carriage upon which the moulds are placed is moved along directly under its nose.

2. ROLLING. The ingots having been cast and cooled are next passed through the rolling mill (*fig.* 3). Its construction differs slightly from that of the common rolling mill. M is a cog-wheel, which receives motion from the driving power of the machine; upon the same shaft are wheels, L and O, gearing into wheels, P and K, upon the axis of the rollers; *gg* (*fig.* 3[a]) are the set screws which serve to adjust the distance between the rollers; and *fig.* 4 shows the manner in which these screws are moved together by the screws, H, turning the wheels, F. The rollers are of steel or iron, case-hardened, and are usually from four to twelve inches in length. When the requisite thickness is thought to be attained, a few blanks are struck and tested in the scales; if they are too thick, the rolling is continued; if too thin, the bars must be melted over again. In some cases a flattening mill is made use of to prepare the bars for the rolling mill; *pl.* 20, *fig.* 7, is an end, and *fig.* 8 a front view of the machine. It is, in fact, a rolling mill, but less substantially built than the one already described, and serves to remove the chief inequalities of the bars, and to extend them slightly. H is the driving pulley upon the shaft of the pinion, G, which engages with the cog-wheel, F, upon the lower roller, *b*, upon the other end of which is a wheel which engages with a similar wheel upon the upper roller. A central wheel upon the top of the machine engages with the wheels, *e*, upon the top of the screws which adjust the distance of the rollers, and turns them equally.

The bars then pass to the *drawing machine*, of which *fig.* 10 exhibits a top, and *fig.* 11 a side view; *fig.* 12 shows the pincers and a section of the drawing plate; *fig.* 13 is a top-view of the vice; *fig.* 14, a front view of the drawing plate.

From the driving-pulley L, motion is communicated to the wheel G, on the shaft of which are two polygonal disks, F, which carry the endless chain *l*, upon which the pincer-carriage travels (*fig.* 12). The bars are secured by screws into the jaws of the pincers, and are drawn through the drawing plate. To diminish the ends of the bars that they may pass through the dies to the pincers, they are introduced between the rollers of a machine, seen in *pl.* 20, *fig.* 9, arranged something like the rollers of a rolling-mill. The upper roller is cylindrical, but the lower is formed with three flat sides. The end of a slip of metal is presented between the rollers while

they are in motion, not on that side of the roller which would operate to draw in the slip between them, as in the rolling-press above described, but on the contrary side, so that when one of the flat sides of the under roller fronts horizontally the circumference of the upper roller, an opening is formed, through which the bar is to be inserted until it bears against a fixed stop at the back of the rollers. As the rollers continue to revolve, the cylindrical portions come opposite to each other, and press the metal, forcing it outwards, and rendering the part introduced between the rollers as thin as the space between their cylindrical surfaces; thus the end of the slip of metal becomes attenuated enough to pass between the dies of the drawing machine and to be seized by the pincers. The drawing plate is seen in *pl.* 20; *fig.* 14 shows the die-box; the dies are adjusted vertically and horizontally, by means of the screws *d d* and *g g*.

The bars are now heated and cut into lengths of about 4 feet, and if, as is the case in the English mint, the breadth is twice or three times as great as that of the coin to be struck, it is also cut through lengthwise. This is effected by means of circular shears, seen in *figs.* 5 and 6; *fig.* 6^a shows the cutting wheels, with the bars lying between them. G is an adjustable ledge, against which the metal plate rests, to regulate the width of the strip to be cut off.

3. The Cutting Out. *Pl.* 20, *fig.* 15, presents a side-view, and *fig.* 16 a top-view of a coin-punch. E is a hollow cast-iron column, from which the atmosphere is kept constantly exhausted; G is a cylinder with a hollow axis, around which it can revolve on the frame H; by means of the tube K the air can be exhausted from the cylinder when required, and motion imparted to the piston in the same, the pressure of the atmosphere upon the piston carrying the punch, C, down, and the fly-wheel, P, raising it again, and returning it to a position ready for another downward stroke.

The blanks cut out by the above machine are then tested, and smoothed upon the surface.

4. Milling. The polished blanks are next milled upon the edge, which operation precedes the stamping, and is performed by a machine shown in *pl.* 20. *Figs.* 19 *a* and *b* are the two milling plates, on the edges of which is engraved the device or motto to be impressed upon the edge of the coin; to the plate *a* is imparted a reciprocating motion by the rack bar *e*, and the blank being laid upon the arm *f* is forcibly compressed between the plates *a* and *b*, and passes out at *g*.

A milling machine is seen in *fig.* 20, by which a single workman can mill 20,000 large coins in one day. The two milling plates E and D contain each upon their curved edges one half of an inscription for the edge of the coins; one of these plates is secured firmly to the bed of the machine, the other to the vibrating lever PD, which turns upon an axis, C; *a* is a tube which supports a pile of blanks, and having an opening at the bottom just sufficient to permit one of these blanks to pass out at a time. As the lever PD is moved, the arm CD attached to it carries out the lowest blank of the pile, which is moved from *a* towards K, between the milling plates E and D, and finally passed out at *b*. More recently, in order to improve the appear-

ance of the rim of the coin, the edges are polished by passing them through a machine, seen in *figs.* 17 and 18, similar to the milling machine, the edge of the disk, W, and the corresponding concave being smooth, so that the edges of the coins, as they are carried through by the revolution of the disk, W, are polished and compressed.

5. STAMPING. The coins are now to be stamped with their appropriate devices upon both surfaces. *Pl.* 20, *fig.* 34, is a section of the principal parts of a stamping machine constructed by Gengembre in Paris. A reciprocating rotary motion is communicated to the triple-threaded screw A, within the female screw N, secured to the frame of the machine U; beneath the screw are the dies G and P, between which the blanks are placed, and as the screw A is turned, it descends upon the upper die and presses it down upon the blank, which is thus stamped upon both sides. That the coin may not lose its circular form, the lower die is surrounded by a steel ring, which just incloses the coin at the moment it is stamped, and retires again that the coin may be withdrawn. That no damage may arise to the machine should the coin fail to enter the ring, the latter is placed upon springs that it may be forced down, and only the blank be injured. Sometimes the coin is surrounded by a ring made in sections, which are brought together at the instant the coin is stamped, and thus the inscription upon the rim of the coin is formed at the same time (*pl.* 20, *figs.* 32 and 33).

After the stamping-screw A (*fig.* 34) rises, the upper die and the parts connected with it are raised by the spiral springs S S, to make room for the next blank. In many of the common stamping machines, the blanks are placed upon the lower die, and removed again after they are stamped by hand. In the better machines, however, this is all done by machinery. The apparatus which affects this is called the carrier, and is operated by the vertical motion of the screw-stamp. This carrier first moves backwards to take up the blanks, then forward, gliding across the ring round the lower die, into which it lets the blank fall; after the coin has been stamped, the carrier strikes it and casts it out of the machine. This is effected by a contrivance (*fig.* 27) called the conductor, on the front edge of the carrier.

Fig. 21 is Boulton's stamping mill in the London Mint, which will not require a detailed description; *fig.* 22 is the guide ring and set screws for the top boxes of the stamping screw; *fig.* 23 is the box for the upper die; *fig.* 24 the box which encircles the upper die; *figs.* 25, 25 , $25,^b$ 25^c, are the details of the stamping ring; *fig.* 26 is the box for the lower die; *fig.* 27 the crescent-shaped conductor on the carrier, which has charge of the prepared coin; *figs.* 28, 29, and 30, show the details of the carrier; *fig.* 31 is the lower box for stamping with a divided ring; *fig.* 32 is a section of the divided stamping ring; *fig.* 33, bottom view of the stamping ring; *fig.* 35 is a view of the stamping machine in which the die is worked by the crank *e*, and levers, *d′*, *c*, and which operates without the violent shaking produced by the machines worked by levers.

In the principal mints the machinery is driven by steam, the pressure of the air being very ingeniously employed to transfer the effective power of

the steam to the stamping mill. *Pl.* 21, *fig.* 1, shows an outline of the stamping machine in the mint at Rio Janeiro. Eight stamping mills are arranged around the receptacle, A, in which is kept a constant vacuum. The vertical stamping screws are moved by chains passing round the drums, E, and attached to the pistons in the cylinders, D. The valves bringing the cylinders alternately in connexion with the vacuum and the atmosphere, are worked by pins upon the fly-wheels, F. *Pl.* 20, *fig.* 37, is the cylinder by which the vacuum and the atmosphere are made to operate the stamps. When the bottom of the cylinder is in connexion with the vacuum chamber, the pressure of the atmosphere which is admitted through the holes, *a*, drives the piston to the bottom of the cylinder and operates the stamps; at this juncture the atmosphere is admitted beneath the piston, which, together with the screw stamps, is drawn back by springs. This cylinder, M, is sunk in the vacuum chamber to the fillet, L, and the cylinder is brought alternately in connexion with the atmosphere and the vacuum chamber by the two-way cock, *b;* the cock *d* is for cutting off communication between the vacuum chamber and any one of the stamping mills that it may be desired to stop. *Pls.* 21 and 22 exhibit specimens of the coins of the principal countries. Their names and approximate values will be found in the Table of Contents.

2. Paper Money.

Paper money is the representative of metallic money, and derives its value from the supposed ability and willingness of the individual or company by whom it is issued to redeem it in gold and silver. To avoid the chances of paper money being counterfeited, care is taken through the whole process of its manufacture to make the imitation of it as difficult as possible. The paper is first prepared with water marks, so that without the co-operation of the paper-maker himself, a perfect imitation cannot be made. The engraving is made as complicated as possible, to increase the difficulty of counterfeiting it, and lastly the bills are numbered and signed by the individuals issuing them, or by their representatives. Bank notes have usually been numbered by hand; but machines have been invented which print the successive numbers upon them without aid in making the changes in the numbers. The most ingenious of these machines is that invented by Bramah in London, and which arranges the numbers with such rapidity that it executes threefold more work than can be accomplished by an active penman. *Pl.* 20, *fig.* 36, is a section of the machine. The numbers are arranged upon a series of rings, I, which are turned by wheels, H, actuated by the motion of the handle, F: these numbers are brought successively from 1 to 99,999 or even higher, beneath the tympan, E, in which position they are inked; the note is then laid upon them, and as the handle, F, descends, the impression is transferred from the types to the paper. The next number in order is then produced by the revolution of the rings as the handle is raised, and the same operation is repeated.

VII. MINING.

Having in the preceding pages turned our attention more exclusively to machinery, we will now treat in separate sections of some branches of Practical Technology, and particularly of the subjects of Mining, Smelting, and Agriculture. We will first take a brief view of MINING, as it relates to the extraction of the economical, or, as they are usually designated, the useful minerals.

INTRODUCTION.

All the useful minerals, in those parts of the surface of the earth to which we have access, are distributed into certain distinct groups. These minerals are distributed among other mineral substances, either in beds or veins. They occur either stratified or unstratified. The former are called *layers*, from the laminated structure they present, and beds. The term bed is principally applied to mineral coal, iron, &c. Layers or beds of minerals are sometimes horizontal, sometimes inclined at a considerable angle with the horizon, and sometimes distorted, bent, and broken. The want of stratification and a tendency to a crystalline structure show that the beds belong to an unstratified or massive formation.

In observing a layer or bed of minerals, we notice first its *strike* or direction, that is, the angle which it makes with the meridian line; its dip, or the angle which it makes with the horizon; the position and character of the hanging wall, or the rocks which bound the top of the bed, and of the foot walls, or those rocks which lie underneath the bed, the former being sometimes called the *roof* and the latter the *floor* of the bed; and finally the out-crop of the bed or its termination in the open air at the surface of the earth. Sometimes layers or beds which are horizontal for the greater part of their extent, rise up towards the out-crop and form basin or saddle-shaped folds. They are then called disturbed strata. We often find local dislocations and displacements of the beds, which are here and there interrupted by fissures which have since been filled up by some mineral substance. These fissures run across all the strata of the formation. These interruptions in the continuity of strata in the same plane, accompanied by fissures, are called *faults*, which term is sometimes applied to the rock filling the fissure. These fissures are generally filled with basalt, or some similar rock; the rock which fills the fissure is properly called a dyke. The complications produced by faults are very diverse; the mineral substance which constitutes the rock above and below it, and the fault which has caused the disturbance, being often mixed together, so that the character of the bed is materially changed. The faults often cause a separation and dislocation of the members of the formation. The thickness of the fault varies from one line to several yards. The strata separated by the fault have frequently suffered therefrom a change of place or a slide

of one part below the other. The strata containing mineral coal, intersected by faults, are generally of soft clay mixed with fragments of trap or porphyry.

Pl. 23, *fig.* 4, shows a section of the rocks containing mineral coal in the region of Newcastle upon Tyne. The scale of the perpendicular is double that of the horizontal distance, so that in fact only half the dip is represented. The line *i i i* represents the great bed or seam of coal, which has a thick bed of sandstone for its roof. The Holywell shaft, to the left of the profile, the Carsdon shaft, *a*, the Algernon shaft, *c*, the Chirton shaft, *d*, the Percy shaft, *e*, the Howdon shaft, and nine others, are cut through beds and seams parallel to each other. The part lying south from the River Tyne, *g*, below the morass of the Jarrow, *h*, some hundred feet or more, is not represented, but may be estimated from what is shown in the section. The dotted lines and the roof of the bed or seam, *i i*, serve as the horizon to aid us in judging respecting the dislocations occasioned by the many faults which have destroyed the continuity of all the strata. In passing from the lowest southern point below the Jarrow morass, the roof of the seam or bed uprears itself at an angle of 10°, and is there interrupted by the first fault; afterwards by the second, which raises it about twelve yards. A third fault meets the bed at D, which sinks it about thirty yards, whence the bed mounts at about the same angle up to C, where it is raised about eighty yards by the fault, so that merely the lower strata of the formation appear. Later it sinks again at B about 22 yards, and then passes on horizontally to a thick fault or dyke, A, which throws down the whole bed about 280 yards, from whence it gradually rises again.

Pl. 23, *fig.* 3, is a section of the coal strata of Ronchamp, A, in the department of the upper Saone. The distinctly marked seams are suddenly broken through by a porphyritic mass, B. In the plains of Champagne, lying beyond the interruption, there has been found a continuation of the red sandstone, C, which forms the roof of the bed of mineral coal, D D; E is the transition slate, and at B, we again find the porphyry. The boring works, *b b*, and the shaft, *a*, are carried down even to the porphyry, B, but the bed of coal has not again been found.

A *vein* is a more or less thick mass of rock of proportionably small dimensions compared with the rock in which it is found, which differs in kind from the rock which incloses it, even when the inclosing rock and vein belong to the same species. We also apply in relation to veins the terms strike, dip, roof, and floor. Although the strata on both sides of a vein have the same successions, they are for the most part dislocated, and therefore do not form opposite continuations. Veins too have their disturbances and contortions, frequently more than beds, and are likewise often pierced through by other veins.

1. Experimental Works.

The existence of localities of beds or veins is usually indicated by out-

ward signs. We trace the head or outcrop of the bed by the *shoads* or loose fragments which have been accidentally detached from it. It is only in particular coal formations that the localities of beds of coal are so clearly indicated as to furnish sufficient grounds for working the mine. If the miner has found the locality of a bed or vein, he must closely examine the region around in order to judge of the changes the formation has undergone. Springs which contain hydrochlorate of potash in solution are usually indications of the presence of beds of coal. Naphtha and asphaltum springs indicate also localities of coal; jets of carbonic acid, or carburetted or sulphuretted hydrogen gas, frequently indicate beds of coal, as well as masses of mineral salt.

If any one, by means of any of the indications above mentioned, has come upon the outcrop of a bed or vein, he must attempt to uncover and display it. He must examine its dips and determine its strike by those parts which are uncovered, and also determine its extent by sinking pits in the vicinity of the bed or vein, and driving transversely to intersect it. The experimental work should be carried on until the miner shall consider himself justified in commencing the real working of the mine. In those cases in which saline or gaseous exhalations serve as indications of the presence of beds of minerals, BORING is the most suitable experimental work.

The earth-borer, or *auger*, is an instrument for boring, in any soil, holes of small diameter, in order that we may not be obliged to sink a shaft or drive a level to learn the nature of the soil. We have already spoken of Boring when treating of Artesian Wells (Vol. I. p. 626), and have represented the principal boring tools, so that we shall here content ourselves with a short enumeration of the same.

An auger consists of an upper piece, which always remains above the hole bored, and of a lower piece, or the auger proper, which takes hold of the bottom of the auger-hole and its sides. The middle piece, or shaft, unites the two pieces above named, according to the depth of the auger-hole. The auger is suspended by means of the upper piece to the rope in the boring frame, and must be so arranged that a person can turn the auger without twisting the rope. The middle piece or shaft is cylindrical, octagonal, or square. The last form is best, because it is cheapest and at the same time admits of manipulation by means of handspikes. The size is according to the depth of the hole to be bored. The diameter is usually 14 lines, but for the greatest depths is as much as 21 lines. Its length is from 16 to 19 ft. Each end is enlarged for the purpose of joining the middle piece to the parts above and below. The most common method of uniting the different pieces of the auger is by means of a male and female screw with triangular threads. The lower end contains the female screw, the upper the male, which is from an inch and a quarter to an inch and a half in diameter. This mode of joining is not so good as the joining by means of a tongue and groove, which admits of turning the auger in all directions.

The boring part of the auger has different forms according to the strata of rocks which are to be penetrated. The chisel auger serves for boring through loose and disjoined strata, like sandstone, &c. In order to fasten

upon the rocky strata in turning the auger, use is made of the carp-tongue or serpent-tongue auger, of the riband-shaped, furrowed, and four-cornered auger. For cutting into quartz, pebbles, or rubble-stone, the conical-headed auger answers. The portions of rock bored out, and the earth, are brought to view by means of the soil-borer or loam-spoon, also by the salt or sand-borer, which is a hollow cylinder having a globular valve below. Sometimes the shaft and boring part break in the hole, and they must be again drawn out. For this purpose a hook is used which catches hold of the bands of the shaft, and in this way it is lifted out. The same object is accomplished by a grappling-tool, which is screwed down in such a manner over the shaft broken in the hole or rope that the claws fasten upon the shaft or rope, which is then drawn up.

For facilitating the operations of boring, variously constructed frames are used. A very good boring-frame consists of four posts for suspending the auger with a windlass and lifting-cams. There is a rope for suspending and lifting out the auger, and a swingle or balance-handle to allow the auger to operate by strokes. This swingle is connected with a lever, which is raised by means of cams on the windlass and falls back by its own weight. This windlass is represented in *pl.* 23; *fig.* 13^a is a side view of the cams or short levers on the windlass. *Fig.* 13^b is a section at AB of *fig.* 13 *c*, seen towards the side of the windlass. *Fig.* 13^c is a front view. The three cams or lever arms, *aaa*, are fixed to the axis M, and serve to make the lever for the swingle, or auger handle, rise and fall. CC are the cast-iron uprights of the frame; M, the axis on which the rope of the auger winds itself; on the same axis is the lift-wheel, *aaa*, which moves the lever of the boring-rod. N is a cog-wheel which catches in the driver *g*; *d* is a set of pinion wheels, the teeth of which have a reversed direction, and in which the pawl *k*, which is fastened on the upper rod, is allowed to catch when it is desired to prevent the backward movement of the windlass. *c* is a wooden wheel on which presses the *brake band*, *e*, which is drawn on to it by means of the lever *f* (*fig.* 13^b). *h* is a *stop* placed on the axis of the crank between the upright C and the enlargement of the axis, to keep the wheel in gear with the pinion. If the stop *h* be raised, then the driver may be released from the cog-wheel, by shoving the axis *gh* through its boxes in the frame CC until the pinion *g* no longer engages the cog-wheel N.

The usual process of boring is briefly the following. First, the surface is attacked by the proper boring tools. With conical-headed augers and chisels, the motion of the auger is by strokes, the tool being slightly turned round. The auger is only occasionally lifted when the borings impede its operation. The expense and difficulty increase rapidly with the depth of the hole bored, on account of the weight of the shank of the auger; for the last few years, therefore, ropes have been used instead of the stiff iron shanks, and with very good success. A tolerably high massive boring-frame, a windlass or vertical capstan, and lever, together with the auger rope and various tools for attacking the rock, are the only things needed in this method of boring, which is represented in *pl.* 25, *figs.* 6, 7, 8, and 9. *Figs.* 6 and 7 represent the boring-frame, the windlass, the swingle, and the

preparatory arrangement of the ground for boring, where the hole to be bored is to be six inches in diameter. The frame has four posts, some 12 feet high, and stands over a shaft about 9 feet in depth, which has been sunk at the commencement of the operations, in the axis of which a wooden tube is placed to guide the auger at the outset. The rope passes over a guiding pulley of oak which hangs above the frame, and is wound up around the axis of a windlass, for which a vertical capstan is substituted when the hole becomes deeper. The longer arm of the lever is 12 to 15 feet in length, and the shorter 2 to 3 feet; the latter terminates in a rounded head which serves to raise the rope with the auger. In order to keep the auger rope always taut, the longer arm of the lever is provided with a hook by which it may be fastened down.

The boring instruments used consist of a simple chisel which is fastened on the lower end of an iron rod (*fig.* 8, front view; *fig.* 9, sectional view), which hangs to the rope by means of a swivel. In the middle it is square, but above and below it has a round flange with four incisions, by which the borings may pass up. The diameter of the flange is equal to the width of the chisel. The hook (*pl.* 23, *fig.* 33) is used to give a twisting movement to the rope. A comparison of rope with rod augers shows that in boring a hole 18 inches in diameter and 200 or 300 feet deep, the cost with the rope auger is greater than with the rod auger; and that in using the latter the cost increases greatly with the depth, while with the rope auger it remains nearly unchanged.

2. Mining for Ore.

The tools of the miner differ according to the nature of the stone or soil. In loose substances, such as sand, gravel, marl, &c., he uses a heavy pick with a blunt point. In soft adhesive substances like peat he uses a cutting tool like a gardener's spade, but which is furnished on the sides with two wings, so that the separation of the peat from the mass is rendered easy. This is shown in *pl.* 23, *fig.* 28[a]. For digging many mellow substances, such as clay, sand, and decomposed rocks, the pickaxe, crowbar, and shovel are sufficient. The pickaxe used, at one end terminating in a steeled point, and with a handle about 2½ feet long, is represented in *figs.* 14 and 15. The size of the iron part is proportioned to the stone to be worked. In working mineral coal the miner makes a deep furrow or trench in a certain part of the mass to be obtained. The trenching tool is a light pointed sharp pickaxe (*pl.* 23, *figs.* 16 *a* and 17 *a*), having the helve in the middle. For hard stone a heavier tool is used. *Pl.* 24, *fig.* 41, shows the miner at work with the pickaxe in soft stone.

Hard substances are obtained by the mining pick or by the aid of fire. The pick (*pl.* 23, *fig.* 19) is a tool of iron faced with steel or made entirely of steel. On one side it ends in a point of the form of a four-sided rectangular pyramid, and on the other has a flat face. The eye of the helve is in the middle. The miner (*pl.* 24, *fig.* 42) places the point of the pick on the

rock which he wishes to obtain, and smites the face of the pick with a short-handled two-faced hammer or mallet (*pl.* 23, *figs.* 20 and 21). The miner has a selection of different kinds of picks, adapted to different kinds of rock. These he arranges on a piece of an iron ring curved like a hook, or has a shap or chain (*pl.* 23, *fig.* 18) with two pieces of hoop iron. Since the employment of powder, the hammer and pick have been used in hard rock only for levelling and digging holes, or where timber-work and machines prevent the use of powder. The mining pick is more useful for working in veins of ore, where also crowbars and large sized steel wedges (*fig.* 29, *a* and *b*) for driving into the fissures of the rock are used.

The use of powder for mining began about the year 1613, and produced an entire change in the mining operations carried on upon solid rock. The first operation in blasting with powder is the drilling of a narrow cylindrical hole, A (*fig.* 9), in the mass to be blasted off. This hole is partly filled with gunpowder, and then, with the exception of a narrow channel needed for firing it off, is rammed down hard, so that the powder which is in the hole on being ignited must exert its force on the rock which surrounds it. *Pl.* 24, *fig.* 40, exhibits a miner busied in the labor of drilling. The holes drilled are from 10 to 48 inches deep, and about half an inch wide. The drill used for boring the cylindrical hole is usually a round iron rod, which ends in a steeled and hardened chisel or cutter (*pl.* 23, *figs.* 22 *a* and *b*). The drill is held in the left hand, and is driven by a hammer. The drill should be occasionally immersed in water to prevent the flying of dust from the hole, and to prevent it from losing its temper by being heated.

In the mines of mineral salt at Northwich, Cheshire, England, they use a drill seven or eight feet long, consisting of an iron rod which bellies in the centre. This drill is held by the middle (*pl.* 23, *fig.* 12). In quarrying gypsum in the vicinity of Paris, they bore with a kind of auger (*fig.* 26). In mining brown coal in Lankowitz, in Carinthia, they make use of an auger (*fig.* 35), provided with a handle like that of a bitt stock, having a flat lance-shaped pod with a small point, the steeled edges of the cutting-tool being slightly twisted. For boring a hole with this instrument three feet, and charging and firing the blast, an hour is sufficient.

After the hole has been freed from the dust and chips by the scraper (*fig.* 23), a dry wad of tow is put on the lower side of the scraper, which absorbs the water in the hole. The hole, when dry, is charged with from two ounces to one pound of powder, wrapped in a cartridge of paper or tarred linen, or if the hole is under water, placed in a well closed leaden or tin cylinder. The cartridge is driven in by means of a rammer (*fig.* 24), which is made of wood, copper, or iron. Previously, however, the priming-rod (*fig.* 25) has been stuck into the cartridge and is introduced with it into the hole. The priming-rod is of copper, and reaches only half way into the powder in the cartridge. The space above the cartridge in the hole is filled with clay, pieces of brick, or pounded slate-stone. This is called the tamping. The first inch or two of the tamping above the cartridge must be only lightly rammed around the priming-rod, and the successive layers

be driven firmer and firmer until the hole is entirely closed to the top. The priming-rod is smeared with tallow, and often turned round during the charging, that it may be easily drawn out. When this is done the train is laid to ignite the powder in the cartridge. The most common modes of igniting the powder are the following. First, by using little tubes of elder straw, &c., filled with fine gunpowder, or brandy and powder, and connected with the cartridge by being placed in the hole left by the priming-rod, or inserted at first instead of the priming-rod; second, by matches of rushes, or shavings, or small paper caps covered with powder and stuck into the hole made by the priming-rod. The fire is communicated to them by the sulphur wick, or a thread prepared by dipping it in sulphur. The slow match of sulphur allows the workman time to escape from the blast. In modern times the Beckford safety match is used to great advantage. The electric spark has proved a very safe and suitable means of igniting the charge, especially when a number of charges were to be ignited at the same time. In this way, in the year 1844, in constructing the London and Dover railroad, a part of the Shakspeare cliff was blasted off and thrown into the sea. A good mode of placing the powder at the bottom of the hole is to use the double cartridge of Chenhall. This apparatus (*pl.* 23, *fig.* 11, *a b*) consists of a copper tube about two feet long and of a smaller exterior diameter than the drilled hole, in which a small piston moves with a graduated rod. The piston is drawn back far enough to allow the requisite space for the charge of powder, which is poured into it, and then the tube is stopped up with a paper plug; it is then put into the drilled hole, and by pressure upon the piston-rod the charge is forced out of the tube, which is then withdrawn and the hole is filled in as usual. This method of charging can only be used where the descent is directly down.

The blasting must be so conducted that the axis of the hole drilled shall be parallel with the nearest open side. The surface of the fracture usually runs through the axis of the drilled hole. For example, if one wishes to blast a mass of rock having the profile A B C D (*pl.* 23, *fig.* 10), a succession of oblique drilled holes will be far more effective than perpendicular ones.

Where the rock is full of moisture, cartridges of tarred linen, or paper cartridges, surrounded with tinfoil, and Beckford's matches, are very useful. A mode of filling a drilled hole when the rock is full of moisture, which is employed in Sweden, is represented in *fig.* 8. The ordinary filling is replaced by two wedge-shaped pieces of iron. Each of these pieces of iron ends in a smooth circular face, of a diameter somewhat less than that of the tin canister which serves for the reception of the powder. The charge of powder used is fastened by a cord on the bottom of the first wedge. The second wedge lies with its inclined plane on the first, and is furnished with an iron rod which projects from the upper opening of the tin canister. In the surfaces of the wedges in contact, there is a channel which reaches to the powder and extends into the tube of a hollow wooden staff which is affixed to the end of the iron rod, after a train of powder has been laid in the channel. *c* is the match affixed to the end of the train; B and C are

two platforms which serve for boring the hole and firing the charge; D is a piece of stone which prevents the wedges and rod from being thrown too far when the blast is made.

Another mode of detaching portions of a rock or bed is by kindling fires on the mass to be operated upon. This mode is used where fuel is cheap and the rocks are not well situated for drilling. The portions of rock detached by the fire may be easily removed by the pickaxe or crowbar. *Pl.* 25, *fig.* 10, represents the working of the mine in the above manner at Felsö-Banya in Hungary. Preparations are made for working the mine by driving levels, which lie nine fathoms below one another, and are connected by shafts and winces. Piles of wood are erected on the bottoms of the levels, the whole length between the shafts, in order that the fire may operate on the roof of the levels. If the level is so high that the flame from combustibles placed on the floor will not reach the roof, a wooden platform is built up from the bottom of the level and covered with stone to protect it from the fire, upon which the piles of wood are placed. The platform is gradually raised as the roof is mined away.

3. Mining at the Surface.

In many cases the best mode of working beds of minerals is to take off the roof of sterile materials which covers the bed, and to work them under the open sky. Such is the case with respect to beds of peat, many stone quarries, beds of bog iron, and in some cases mineral coal.

In general, the following rules are to be observed in mining under the open sky: In the first place, a sufficient portion of the bed or vein to be mined must be laid bare, in order that the materials to be dug out may be easily procured. We must then descend as far down to the lower part of the bed as can be done without threatening the caving in of the walls. Secondly, we must provide the means of containing water if it collects on the bottom of the mine; all the water should be collected at one point, where the pump is placed. Thirdly, after the first bank or step is wrought out we go on to the next, taking care that a drain is left under the rubbish of the first step to carry off the water. Fourthly, the general rule is to commence at the lowest point in the bed and carry on the mining from below upwards, by cross-cut on the longer line of the bed.

As an example of mining at the surface, we will here give a plan of the operations at the slate quarries near Angers in France. These quarries lie east of that city, on a series of beds of slate which have an average extent of two to three miles, and run in a direction about twenty degrees north of west. In the year 1841, 14 quarries were being worked, with a yearly production of about $4,000,000. The beds dip almost vertically, but usually a few degrees to the north (*pl.* 23, *fig.* 6 D). The separation coincides with the stratification, as the flattened impressions of organic remains which are found abundantly between the layers show.

The slate quarries belong to different companies. The operations of each

quarry are under the charge of two superintendents, one of whom directs the labors of the quarry, and the other those above-ground. After the soil and clay produced by the decomposition of the slate, which is often quite thick (*figs.* 5, 6, and 7), have been removed, the rock is worked by steps or banks about 10 feet high each, as is shown in *figs.* 6 and 7, so that an oblong square excavation is formed. Two walls in the quarry are made vertical. On the firmest of one of the upper steps, a wooden platform is erected. This platform carries a pulley, upon which runs the hoisting rope (*figs.* 6 and 7). The platforms are connected by bridges, with sheds, A B C, where the steam-engines are set up. In commencing the quarrying, a notch is made with a pickaxe, and widened into a trench of about 3 feet broad (*fig.* 6), and the slate is taken out on both sides, so that the quarry has always steps upon which the workmen may take their places. To cut in each step, the workmen dig in the fissures of the rock with their pickaxes a series of notches, in which wedges are placed (*pl.* 25, *figs.* 31 *a* and *b*), 25 or 30 of them for every 28 or 35 feet. The workmen all stand in a line, each man to a wedge, and smite with heavy hammers on the wedges, keeping time in their blows. As the slate splits open and the wedges sink, thicker ones are put in their place, until the rock breaks at the bottom and tumbles down. When the rock cannot fall by its own weight, an instrument, represented in *pl.* 25, *figs.* 34, *b* and *c*, is laid on the cleavage of the slate. To this a rope is fastened, and pulled by ten or fifteen men. *Figs.* 32 *a* and 33 show a hand crowbar which is used. The steps cut on each side of the shaft are indicated by the horizontal lines on *fig.* 6. For some time past blasting has been used to advantage, several holes being charged and fired off at once.

When a block is quarried off, it is divided by means of the irons (*pl.* 25, *figs.* 31 *a* and *b*); the drill-wedge and pick (*fig.* 30 *a b* and *fig.* 32 *d e*), the pickaxe and hammer are also used. Each block is divided into pieces of convenient size. The pieces are then loaded into boxes (*figs.* 27, 28, and 29), and carried up to the top of the quarry. The slate is carried from the hoisting-shed to the platforms around the quarry, where it is prepared. This is done in the open air. A working gang consists of three persons, two splitters and one apprentice. The blocks are divided into smaller pieces, having the general form and dimensions of the different kinds of slates. The blocks of slate are divided by placing a flat chisel (*figs.* 32 *b* and *c*, and 35) in one of the clearly marked divisions of the slate, and striking it with a wooden mallet. The slates are then laid flat on a wooden block, and fully smoothed off with a kind of knife.

Another kind of work at the surface is the digging of peat. Beds of peat occur in the flat regions of rivers in the north of France, Holland, and the plains of lower Germany, also on high plains without trees.

The thickness of a bed of peat may be discovered by the peat-borer (*pl.* 23, *figs.* 32 and 34). This is a simple half-opened scoop auger, which is two or three inches in diameter, and is fixed to a pole 15 or 20 feet long, on which is marked a scale for measurement. Peat is usually soft enough to be easily dug by means of a cutting instrument, and from the firmness

of the mass may be cut vertically to a considerable depth without any fear of its caving in. Care should be taken that no heavy weight is placed on the edges of the pit. On account of the situation of the peat beds, they can rarely be thoroughly drained without great cost. Where the water can be managed by buckets, small trenches can be dug, and the peat easily obtained by means of the usual spade (*fig.* 27) or the spade with sides or wings)*figs.* 28^a and 28^b). Where the peat-bed is covered with water, and the draining is too expensive, the peat is obtained with nets. For obtaining soft peat a net is used, similar to that with which sand is obtained from the bottoms of rivers. If the peat is firm enough, a rim of hoop-iron is used, on the circumference of which a net is fastened. The rims of the nets used in Holland are from 12 to 22 inches in diameter. The peat obtained by the net can be dried in drying-boxes or moulds.

4. Drifts or Levels.

The excavations intended to reach veins or localities of ore in order to unite them with the surface of the earth, and which have a small sectional area in proportion to their length, are called drifts and levels, or shafts, according as they approach a horizontal or perpendicular direction.

The adit or adet-level is a horizontal gallery, terminating in the open air, and which generally serves for draining the mine. Levels are horizontal excavations driven on the lode. Cross-cuts are levels driven at right angles with others to intersect the lode.

The mode of working the levels, and the tools used for the work, vary according to the condition of the rock to be operated upon. In hard rock the levels are driven without the support of carpentry or masonry. In soft and crumbling rocks carpentry or masonry must immediately follow the mining operations, and frequently precede them. In hard rock the levels are mined by blasting or by means of hammers and picks, or strong steeled wedges or gads (*pl.* 22, *figs.* 31^a and 31^b). A section of the drift or level has usually the form of a trapezium. The upper side is semicircular. The height of the level may be 5 to 6 feet, and the width at the bottom from 3 to 4 feet; but generally the height is 6 feet, and the width at the bottom 4 to 5 feet. The adit level serves at the same time for conducting off and obtaining water. When the water covers the bottom several inches deep, the adit may be divided into two parts by a horizontal partition, which is in fact the roof of the conduit for the water. On this roof is constructed the forwarding floor, and beneath it, on the floor of the adit, the water flows from the mine. The roof of the conduit is 14 or 16 inches above the bottom of the drift, and the gallery above this roof is 5 to 6 feet high. The roof of the conduit consists of boards, which are nailed on beams or sleepers. Drifts or galleries with a very large cross-section, called tunnels, are driven forward by steps, so that part of the tunnel which is being wrought has the appearance of a flight of stairs with several broad steps, each one of which can be occupied by a workman. The obtaining of a cubic foot of

rock in a wide drift costs far less than in a narrow one, not only on account of the greater facility of working by steps, but because the extent of space lightens the work. In soft but tolerably compact rock the levels are wrought by means of pick and wedges without blasting. The rock stands long enough to admit of carpentry or masonry being subsequently constructed, to prevent future falling of the walls and roof.

1. Timbering of the Levels. In driving a level which must afterwards be timbered, care must be taken that the requisite space within the timbers is secured. Timber-work is almost always cheaper than masonry, but wood rots and gives way under the pressure of the rock, and therefore requires to be replaced from time to time. In works upon a mine which is to be used only two or three years, timbering is used; while in large drifts or adits which serve for draining the mine, and therefore require to last for a considerable time, masonry is adopted.

Before considering the details of timbering, we may make the following preliminary observations: First, we must observe the degree of compactness of the rock, and determine as far as possible the direction of the pressure. If, for example, the rock is split through in many places, and consists of broken and loose masses of stone, this is a sign that the mass exerts strong pressure, and must be supported by timbering. As the pressure of the rock is not always vertical, but lateral, the resistance furnished must correspond with the pressure. As the pressure which the mass exerts upon several points is less than when the whole mass has to rest on a single point, we must seek to bring the pressure to bear upon as many points as possible.

The ends of every cross-beam used in a mine should lie in the rock. Two mortises or hollows must, therefore, be cut in the rock in which the ends of the cross-beams should lie. These mortises must be 8–12 or 24 inches deep, according to the character of the rock.

The cross-timbers are round, hewed, or split pieces of timber, which are laid in a horizontal position within the level, parallel to each other, and at such distances from each other that from three to five may occupy a length of six yards. The timber-work of the levels further consists of double and single upright posts, standing under the cross-beams. In mining operations it often happens that the roof and sides of the level when it is first excavated are perfectly strong, but in the course of a few years large masses give way both in the roof and sides. Whenever there is any apprehension of this difficulty, double upright posts are chosen for timbering. If weakness in the roof alone is apprehended, the single uprights are used. The double upright posts stand perpendicularly to the bottom of the level, and are connected at the top by a cap or cross-beam. A single upright stands alone under the cap. At Freiburg, in Saxony, where the lodes are not thick, and the levels, consequently, are narrow, all the uprights are placed vertically; but where the lodes are thick and the levels widen, the uprights or posts are placed wider apart at the bottom than at the top (*pl.* 25, *fig.* 11[a]). This is made necessary by the width of the levels and the pressure. The uprights are set up slanting wherever the side pressure is greater than the pressure

of the roof. After the uprights are placed, covering-boards are fastened upon the caps and upon the sides behind the uprights, in such a manner that they may lap over towards the rock. Where the pressure of the rock is not very great, the second upright is placed about three yards from the first. When the pressure is more considerable, an auxiliary upright is placed half way between the two.

When the level is very wide and the cross-beam does not appear sufficiently strong to resist the pressure, it is strengthened by means of braces of joists, which meet under the centre of the cross-beam and rest on the sides of the uprights. Where a level is employed for ventilation, draining, and often even for mining itself, the timber work has an appearance like that represented in *pl.* 25, *fig.* 13, in which both the uprights lean against each other at the top, and stand below on a horizontal beam or sill. This timber-work is simple and cheap, and requires but little room. This method of timbering is much used in the copper mines of Cornwall. Another kind of timber-work used in rubble-stone which has but little pressure, is represented in *fig.* 11^b. It consists of four posts or planks, from 2 to 2½ inches thick and 12 or 15 inches broad. These planks cover four sides of the level, and are so placed that the ends of the upright planks are behind the ends of the other two. The planks are held together at the corners by square blocks or pieces of joist, against which the upright planks are nailed. There should be no empty space between the planks and the ground in which the excavation is made.

If the ground is so soft that it will not sustain itself at the least distance from the upright posts, the timber-work must, to a certain extent, precede the mining operations. The process adopted when certain strata of sand or clay are entirely pervaded by water, forming marshy or what is called compressible soil, is as follows. Two upright posts with a cap are placed in the level to be driven. If the bottom is not solid they must be placed upon a sill. When a square frame has thus been set up, a covering of plank piles, or sheeting piles, is driven in around the frame. The sheeting piles must always be introduced at a slight divergency, so that the whole piling may have the form of a truncated pyramid, the smaller end of which embraces the first frame set up. If the ground is not very soft, as soon as the piling is inserted, the level may be driven onward 20 or 24 inches, after which a second piling is placed exactly like the first. In driving the level care must be taken to keep the course perfectly true. The divergency of the piling must be preserved. The piling is kept at some distance from the second frame by wooden wedges, which are driven in between the piles and the frame. The piles are afterwards driven further into the ground by beetles, and then the mining of the level is further carried on until a third frame is set up. The piles should not be longer than 6 or 8 ft., and, therefore, after the fourth frame is set up, new piles must be placed. The second set of piles lie on the frame and below the ends of the first, so that wedges may be driven in between them. As an example of this mode of working in marshy ground, we will describe the operations in the mine of argentiferous lead ore, called the Frederick mine, at Tarnowitz, in Upper Silesia

(*pl.* 25, *figs.* 15–17). When marshy ground is met with in driving the levels it is shut in to prevent the caving in of the sand and clay. A square frame, like that described above, is placed against the marshy soil which is to be driven through, and behind it cross-boards, forming a bulkhead, are placed, which are kept up by the frame (*figs.* 15, 16.) If the bottom is bad, the uprights are set on a wooden sill, formed of a half-round board split from a log 16 or 20 inches in diameter. The flat side is placed on the ground. Pieces of board are sometimes placed below the sill to give it more support. The sill is made as long as possible, in order to rest in the earth on each side. After the sill has received its position, the two uprights are set up accurately perpendicular, and are bound together in the usual manner by a cap. The ends of the cap do not project beyond the uprights, as is seen in *fig.* 15. After the frame has been put in place, sheeting piles of plank are placed around the uprights and the cap, and are retained at the requisite distances from the frame by wedges. The wedges lie on the piles already fastened in, and by driving the wedges the position of the frame can be accurately adjusted. The piles are then driven in, commencing with the two which rest on the upper corners of the frame, being made broadest at the end which is driven in. The cap is first covered, and afterwards the uprights. In this mine, where the pressure was very strong, piles formed of plate-iron were used.

To carry on the mining, the topmost of the planks which shut up the end of the level, as is shown in *fig.* 15, is lifted up or moved from side to side, and as much of the earth taken away as can be done without reaching the end of the piling. This plank is afterwards shoved further forward and fastened by two short braces or ties to the last frame which has been set up. The plank when pushed forward is somewhat raised, that it may touch the piling with its upper edge. The section of the planks and side elevation of the braces or ties are shown in *pl.* 35, *fig.* 16. If the ground is very soft or marshy, the water is drained off, and this drainage so regulated that the water may be withheld at pleasure; otherwise it might fill the level and displace the frame. As soon as the workman sees that a sufficient quantity of water has flowed out, he presses back the plank, or stuffs in a bundle of straw. Short braces are driven in by hammers between the uprights and the plank, in order to push forward the latter. When the highest plank has in this way been shoved forward, there remains between it and the one which is under it, and which has not been pushed forward so far, an empty space, through which the mud sometimes flows out. This must be kept under command. In this way by a successive pushing on of the planks, the end of the piling is almost reached. Then another main frame must be forced in and new piling fastened by wedges. If it is apprehended that the framework is not strong enough to resist the pressure, strong pieces or longitudinal beams are placed under the caps, and on the sills and between them perpendicular posts are placed, as is shown in *figs.* 15 and 16.

In ground where the pressure is very great much is accomplished if even a narrow passage can be effected, because by opening and draining the ground it is prepared for subsequent working. For this purpose, at Tarno-

witz, temporary posts are erected on timbers placed in a wedge form, and a narrow opening, gradually enlarging, is carried forward in the ground to be worked (*pl.* 25, *fig.* 17). After the ground is drained permanent timber-work is constructed.

2. Masonry of Levels. Masonry is always to be preferred to timbering if the adit or level to be driven is to remain open for several years, and cheap and durable materials are at hand. Masonry is indispensable where the adit or level is driven in very soft or marshy ground, where the object is not only to resist the pressure but to prevent the flow of water into the mine, and in all wide galleries or tunnels, such as are made on canals or railroads. All kinds of hard stone are used as materials for masonwork. When bricks are used they must be burnt very hard. The stone obtained in the mine is rarely suitable for the masonry of the adits or drifts. For dry masonry only rubble-stone and moss are used. For cementing the mason-work common lime and sand mortar or hydraulic mortar are used.

There should be no empty space behind the masonry, or between it and the walls or roof of the drift. If this essential condition is secured, mason-work will receive a pressure on all parts of its exterior surface, and therefore can only be destroyed by falling into the inside of the drift. In ground where there is no very strong pressure, and where at the same time the roof and the walls or sides of the drift are to be sustained, the masonry generally consists of a semicircular vault, or a right cylindrical arch resting on two piers extending perpendicularly along the walls of the drift. If the bottom of the drift is incapable of supporting the piers, the following means of obviating the difficulty are adopted. 1. The piers are placed on sills of oak wood, as in *pl.* 25, *fig.* 12. 2. Beneath this sill is constructed an inverted or *reversed arch*. 3. A perfectly closed elliptical arch is constructed, the longer axis of which is vertical (*fig.* 14). The first method is adopted when the side pressure is weak. The second and third are resorted to when the drift is of large dimensions and the pressure is very considerable. The lower curve of the ellipse may be flattened to prevent the gallery from being too high.

We will now refer to some examples of the appropriate masonry of mines. In loose ground, like clay, sand, &c., and at a slight depth below the surface, where the excavation is afterwards to be built in with masonry, the walls and roof are temporarily supported by props and cross-beams. In this kind of ground, dry walls filled in with moss are often used, which are made 29–24 inches thick. These walls are better in marshy ground than those cemented with mortar. If the pressure is very considerable, and the ground at the same time marshy, hydraulic cement is used, and small canals are left here and there, by which water may flow into the adit.

If the proper curve for the arch of the masonry is fixed upon, centrings, constructed according to the condition and weight of the masonry, are placed for supporting the arches while being built.

The most general rule for constructing arches in the adits or drifts of mines is, that the chord of the arc should be perpendicular to the direction

of the pressure. If the bottom and sides of the drift are capable of sustaining pressure, but the rock above or in the roof exerts a perpendicular pressure, an obtuse or surbased arch is employed. If parts of the walls of the drift are cracked and loose, the abutments of the arch should be laid deeper into the rock or ground on the sides of the drift, or so far that a solid point is found for them to rest on. If the sides of the drift are so broken that no solid support can be found for the abutments, the span of the arch may rest on the firm bottom of the drift, or strong slabs of stone. The section of the arch then forms an ellipse compounded of many arcs of a circle. If the sole or bottom of the drift is so yielding that no firm ground can be found even by excavations, then ground or foundation arches must be constructed. These are flattened arches the chords of which lie in the direction of the drift, the impost of each arch being on points of the sole which have been ascertained to be perfectly firm (*pl.* 25, *fig.* 20 *a b*). Upon these foundation arches the side walls are constructed. Various means of remedying the want of firmness of the sole of the drift may be resorted to. The sole may be covered with large slabs of stone, or an inverted or counter-arch may be constructed, and on its springings the side walls may be erected. If the sole is wholly excavated and peculiar strength is to be given to the gallery, sustaining arches may be thrown across the drift under the bottom of the gallery which is to be constructed. The arches should be at a distance of from four to eight feet from each other (*pl.* 25, *fig.* 21 *a b*). Against the springings of the sustaining arches, and at right angles to them, the ground arches above described (*fig.* 20) should be constructed, and upon them the walls of the gallery or adit are built. Rubbish should be placed so as to fill up the space beneath the sustaining and ground arches. If, finally, there is nowhere any solid rock, and the bottom of the drift is wholly soft and yielding, continuous elliptical curves must be used to form the gallery (*pl.* 25, *fig.* 14).

Pl. 24, *fig.* 2, represents a mode of constructing the masonry of an adit where the foot-wall furnishes the only firm support. The foot-wall forms part of the bottom of the adit, and a partial ellipse of mason-work is made to rest on steps or projections of the firm foot-wall.

Recently whenever practicable, an entire or partial ellipse has been used in the masonry of levels and adits. One advantage in using the ellipse is that it may be constructed within timber-work and piling, which is first constructed when the ground is soft and compressible (*pl.* 24, *fig.* 1).

In building the roof arch, centrings are necessary, as in masonry above ground, and the work is carried on in the same manner, except that the confined space makes it more difficult and tedious. The laying of the keystones in such cases requires particular care and skill. After the completion of the section of an arch, such as is shown in *pl.* 24, *fig.* 6, the centring should remain several days before it is removed.

A peculiar method has been adopted in the lower levels of the mines of Freienwalde in Prussia. Here an iron supporting-arch was made use of to preserve the roof and sides of the gallery while the arch was being constructed, to keep out the water. The walls of the galleries are vertical, and

covered with a semicircular arch. The sole, where it consists of sand, and there is not an excess of water, stands very well. When it is very wet it becomes necessary to turn a reversed arch, upon which the walls of the gallery are built. Only one iron centring is used while constructing the arches, which is moved forward as the work proceeds. It is made of wrought-iron, and consists of three ribs which have the form of the outside of the walls (*pl.* 25, *fig.* 18). These exterior centrings, if they may be so termed, consist of three parts, the bottom piece, and two similar half arches which lap over each other in the middle, and are fastened together by means of screws. The iron sole rests upon another of wood, and the three ribs of the centring are placed nearly two feet apart. Upon these ribs lie about forty iron plates, seven to eight feet long, half an inch thick, and four inches wide. By this means the walls and roof of the excavation are secured for a distance of seven feet, and when the arch is completed the supporting frame is moved on to support the next stretch.

Most of the machine-chambers below ground consist of rooms for the water-wheels which are connected with the pumps, the steam-engines being very seldom beneath the surface. These chambers require to be walled up, partially or entirely, and great care is necessary in their location, as serious accidents may occur, entailing costly repairs. In *pl.* 24, *figs.* 3, 4, and 5, is seen a wheel-house as usually walled up in the Saxon mines, the wheel being indicated in *fig.* 3 by the dotted circle. The water is admitted through suitable openings in the roof if the wheels be over-shot, or through the side walls of the chamber if under-shot wheels be used.

5. Sinking of Shafts.

When a shaft is to be sunk into solid rock it is done by blasting. In this work great inconvenience is caused to the workmen by the water which issues from the clefts in the rock and falls down upon them. In order to prevent this a gutter is cut in a spiral form along the sides of the shaft (*pl.* 25, *fig.* 22), emptying into a small excavation in the solid rock, calculated to contain the water discharged in twenty-four hours, from which the water is raised in buckets when it is full.

In England, especially in the vicinity of Newcastle, the shafts are made circular, the smallest being ten feet in diameter. The circular form is well adapted to shafts in strata of a small dip, and is also much used in the Liège coal-mines, and in some parts of France. For shafts in rocks of great dip, the rectangular form is preferable, particularly when they are to be timbered; in Germany therefore the rectangular form is generally used, and the masonry is executed in four arches abutting against each other in the corners.

1. Timbering of Shafts. The timbering of the shafts is the woodwork necessary to support the sides. In shafts which are to serve for a short season only, a temporary timbering is made use of, constructed in the following manner. Green oak, birch, or beech, is bent into hoops, which are placed one beneath the other as the shaft proceeds, and serve

to support the sides for a limited period; this method is not expensive, and is not resorted to in excavations of an enduring character.

In permanent shafts timbering of a more substantial character must be made use of. The shafts intended to be stayed with timber are usually square or rectangular, as this form renders the timbering easier. Where the pressure of the earth is not excessive, the timbers are placed three or four feet asunder; where the earth is moist, it becomes necessary to place them closer. *Pl.* 25, *figs.* 23 *a* and 24, show the arrangement of the wood-work in elevation, and *fig.* 23 the same in plan; *fig.* 25, vertical section of the timbered shaft. As seen in *fig.* 23 *b*, the shaft is divided into three divisions, one for the service of each of the tubs, and another for the ascent and descent of the miners.

Pl. 24, *fig.* 7, shows the first steps to be taken in sinking a shaft. The lower and stronger beams of the frame for supporting the windlass are parallel with the short sides of the excavation. 6 or 8 feet below the surface the first rectangular frame of the timbering is placed, which serves as a guide for the balance of the shaft, the sides of which, as the work progresses, are supported by similar frames at suitable distances from each other, and have joists driven down behind them, the spaces between which and the walls of the shaft are filled with blocks and wedges of wood, to give them a firm bearing, and the longer sides of the framework are strutted with stout cross-timbers, the ends of which are seen in *pl.* 25, *fig.* 26; these timbers are more clearly seen in *fig.* 23 *b*. *Pl.* 24, *figs.* 8 and 9, represent different methods of shaft-timbering.

In very wet mines it becomes necessary to dam out the water, which is done either with oaken frames, with cast-iron cylinders, or with masonry laid with hydraulic cement. *Pl.* 24, *fig.* 18, is a section of a shaft of a coal mine in Belgium thus walled up.

It often occurs that shafts pass through strata of coarse sand filled with springs; in this case the excavation is opened much larger than it is ultimately to remain (*pl.* 24, *fig.* 21), and lined with a double timbering, the intermediate space being puddled with tenacious clay; this, however, can only be accomplished when on penetrating the sand a firm impermeable stratum is reached.

As an example of damming out with cast-iron, we will give an instance which occurred in a coal mine near Newcastle, England. At a depth of 42 feet from the surface, a spring was encountered which poured in 200 gallons of water per minute; the workmen having succeeded in penetrating to a firm impermeable stratum below, a carefully prepared ring of oak was laid at the bottom, upon which segments of cast-iron were placed, the joints between the segments being chinked with strips of wood, and the space being well puddled, by which the water was completely shut out, and a foundation was furnished for the masonry above, which was placed directly upon the iron segments.

Further down a copious spring was encountered, which required a similar dam of nearly 40 feet in height, the segments being rather thicker than those above.

At a depth of 216 feet a third tubing became necessary for a distance of 24 feet, and at a still greater depth a fourth was required. *Pl.* 24, *fig.* 19, is a vertical section of a portion of this dam. Above these cast-iron cylinders the shaft was lined with stone masonry.

There is another species of damming, in which, instead of lining the gallery or shaft, the point from which the spring has burst is plugged up as it were. This occurs most frequently in a gallery, the whole of which, in such cases, is often closed by the dam. A bed of moss is first laid upon the sole, and the timbers of the dam are then built in, wedged, and caulked with moss. *Pl.* 24, *fig.* 28, shows an instrument used for enlarging the openings between the timbers, and *fig.* 29 the chisel for driving in the moss; *figs.* 26 and 27 are sections of such a dam, propped upon the front side to prevent bending; *figs.* 22 and 23 are instances of the same in vertical shafts.

Sometimes the wall of the shaft is built upon an iron shoe, sharp at the bottom, and the excavation is made upon the interior, the shoe cutting its way down as the work proceeds, and sinking gradually with the wall. Between the wall and the sides of the shaft are scantlings, placed vertically to prevent interference between the masonry and the sides of the cut (*pl.* 24, *fig.* 20). At other times the sides of the shaft are supported at the time it is sunk by a temporary timbering of scantling (*pl.* 25, *fig.* 19), which gives place where the shaft is entirely excavated to the masonry walling.

2. Shaft Masonry. When shafts are to be kept open more than six or seven years, masonry is preferred to timbering. The masonry is either laid in common or hydraulic cement, or is carried up dry where the ground is free from water. When one or more sides of a shaft are to be secured by masonry, arches are sprung over the level below the shaft (*pl.* 24, *fig.* 13), and on these arches the masonry is carried up, presenting either a straight face to the shaft (*pl.* 24, *fig.* 10), or the concavity of an arch (*fig.* 11) when the rock is rather loose, and exerts a considerable pressure on the wall. The empty spaces behind the walls are packed with rocks. *Figs.* 12 and 14 are sections of a rectangular shaft, all four sides of which are secured by masonry; *fig.* 15 is the plan. In shafts of great depth a partition-wall is built, separating the ascent-shaft from the service-shaft, and affording additional security to the masonry of the long sides of the shaft. Wooden partitions are also often made of boards nailed against cross-pieces fixed in the masonry; the boards are tongued and grooved, and closely fitted, the division of the shaft into two spare spaces serving for ventilation. *Figs.* 24 *a*, 24 *b*, and 25 *a*, 25 *b*, show a wooden partition; at the lower end (*fig.* 24 *b*) it is inclined to the side of the shaft, in order to prevent the buckets from catching under it. The ladders stand in the smaller portion of the shaft on foot-boards (*fig.* 25 *b*), which occur every 30 feet; each foot-board has a man-hole (*fig.* 25 *a*), through which a man can pass freely.

In inclined shafts the masonry of the short sides is made in the same manner as in vertical shafts. The upper side is secured by a flat arch, or according to the dip and pressure of the strata by arches of more or less rise, resting below on strong supporting-arches (*pl.* 24, *figs.* 16 and 17),

which span the gallery into which the shaft enters. When the shaft is very wide, as when the ascent-shaft, service-shaft, and water-shaft, are contained in one, a single arch would require a great excavation into the strata over-head, and great thickness; it is preferable, therefore, to build one or two partition-walls, and to arch each part of the shaft separately.

When at any part of the mines a powerful spring is encountered which cannot be cut off at a higher point, it may sometimes be backed up by a dam or bulkhead until it breaks out at the surface. This method can only be resorted to when there are no clefts in the formation through which the water might issue at another point, or perhaps even at a greater depth. A bulkhead for this purpose consists generally of strong beams of oak timber, closely fitted and caulked with moss or oakum with the aid of caulking-irons (*pl.* 24, *fig.* 29), and then wedged with wooden wedges, which are inserted by the aid of a kind of chisel, shown in *fig.* 28. A bulkhead of this kind, built in the lead mine of Huelgoet, in France, is represented in *figs.* 26 and 27. For the purpose of caulking on the water-side, a hole was left in the centre, which was afterwards closed with a wedge-shaped block of beech wood. The space behind the bulkhead was filled with concrete made with hydraulic cement. The ends of the beams bear against a rectangular offset in the rock on both sides of the bulkhead, which is, moreover, stiffened by braces on the outside.

When a shaft in a wet mine is abandoned, it is often necessary to shut off the water from the mine by a bulkhead, across the shaft below the wet strata, in the solid formation. The part of the shaft above the bulkhead is generally filled up with rock. A horizontal dam or bulkhead of this kind may be built of masonry or timber; in the former case the spherical form is to be preferred; a bulkhead of timber is represented in *pl.* 24, *figs.* 22 and 23. The ends of the beams and the side beams are bevelled, and rest on a shoulder in the rock, as seen in the plate, where they are wedged tight; the centre or key-beam is held in its proper position by means of a strong iron eye-bolt, *b*, while the whole bulkhead is caulked and firmly wedged up. Any subsequent strain of the timber is prevented by bracing on the top of the bulkhead.

6. Working the Mines.

Mines may be divided into two classes according as they are worked. In the first the economical minerals are found in connexion with the *gangue* and sterile rocks, which are separated in the mines, and are suitable for walling and protecting the passages. The second class embraces those mines in which the *deads* are not serviceable for the above purpose. To the first class belong most metallic mines, and to the second, mines of coal, salt, &c. Mines may be worked either by *open* or *subterranean excavation.* The former are the least expensive, when not pushed to a great depth; and are preferred for mineral deposits lying near the surface, for building materials, lime, &c.

Pl. 24, *fig.* 43, exhibits a general view of the subterranean operations as conducted in steps, which is called *stoping;* by this process the sole of an existing *level* is cut down by steps, or the work may be commenced directly from the foot of the shaft; after the work has proceeded for some time, the excavation presents the appearance of a series of steps, as seen in *fig.* 43. The height of a step is generally to its length as one to three or four; a similar method is adopted in the gold mines of Morro Velho in Brazil (*pl.* 25, *fig.* 4). The thin coal-seams near Mons are worked in a similar manner, a main shaft for the working of the vein and another for the pump being the first sunk (*pl.* 26, *fig.* 3); these shafts are then united by a cross-gallery and two principal levels are then driven, the one upon a level with the bottom of the pump shaft, and which serves to carry the water to the sink, called the *sump*, *c*, the other serving as a working level for the seams above. In *pl.* 24, *fig.* 32, the levels are run parallel with the vein. Upon the left is seen the water shaft, and above it the working shaft, from which leads out the working gallery; *b* is the ground level, which leads the water to the sump.

Pl. 26, *figs.* 4 and 5, show a mode of operation practised in lieu of stoping, in horizontal or slightly inclined veins. P is a working shaft, and P′ serves for the pumps and also for ventilation; AB is the principal working level, either horizontal or slightly inclined towards A.

A variety of methods are adopted in the working of those mines which do not furnish the material with which to support the roofs of the excavations. Pillars are left which are just sufficient to support the strata above, or massive columns are left, a large portion of which is removed when the regular working is finished. In other cases levels are driven forward and the pillars are cut away by working backwards, allowing the whole superincumbent strata to fall down and follow the miners in their retreat. In highly inclined veins covered levels or galleries are oftentimes necessary for ventilation (*pl.* 26, *fig.* 26 *b*), in which *a* is the gallery, *m* a pillar, and *r* the passage for the draught.

Pl. 25, *fig.* 5, represents two coal seams, one immediately above the other. In such cases the upper seam is first worked and the pillars removed, and two years afterwards the lower seam is worked by long pillars and galleries running in the direction of the dip; the pillars are then removed, and the whole is allowed to fall in after the miners.

Pl. 24, *fig.* 31, is the plan of a Sunderland mine in an immense field of a million square fathoms. The whole is set upon pillars, and the work is driven as far as ventilation and the power of removing the coal to the main shaft will permit. A are the large safety pillars; B is the ventilating shaft; C, a shaft or inclined level.

Pl. 25, *fig.* 3, shows the method adopted in the silver mines in the vicinity of Freiberg, and in the iron mines of Müssen in Rhenish Prussia.

7. Ventilation of Mines.

The air in mines becomes unfit for respiration either by the consumption of oxygen by the miners and lights, or by the development of gases which are dangerous or at least do not sustain life, as carbonic acid, hydrogen, sulphuretted and carburetted hydrogen, carbonic oxide, sulphurous acid, and the fumes of mercury and arsenic. When there is no reason to apprehend the presence of inflammable gas in a mine, the condition of the air is readily investigated by lowering down a burning candle, which will only burn in respirable air; the presence of sulphuretted hydrogen is recognised by the smell, or by the blackening of strips of paper dipped in a solution of acetate of lead. When carburetted hydrogen, called *fire-damp*, is suspected, a safety-lamp is lowered, the wire cylinder of which will become entirely filled with flame when the air contains one sixth of the gas; when one half of the volume of the air is composed of carburetted hydrogen the lamp will go out. The practice of setting fire to the inflammable air in mines, which was formerly often resorted to, is very objectionable, being not only dangerous to the workmen engaged in doing so, but also to the mines which are set on fire, besides having the disadvantage that two volumes of oxygen are consumed for each volume of inflammable gas.

The only effectual way of purifying the air in mines is by the copious introduction of pure atmospheric air, a continuous current of it being made to enter the mines at one point, and passing out at another after circulating throughout the excavations. This ventilation may either be produced solely by the difference in gravity of the external air and that in the mines, aided by a judicious arrangement of the excavations, when it is called *natural ventilation:* or else it is caused in part or entirely by machinery, producing *artificial ventilation.*

1. Natural Ventilation. In mines with but one surface opening, whether a shaft or a gallery, the ventilation is very much assisted by large dimensions which allow two opposite currents of air to be formed without interfering much with each other. In shafts the dripping of water at the sides promotes a downward current of air, while an upward current takes place in the centre. By dividing a shaft or gallery into two parts by a closely fitted partition, the ventilation is much augmented; one of the parts may be advantageously connected with an air-chimney. The wind may also be temporarily made use of by means of a windsail.

The natural ventilation generally exists in a sufficient degree in mines with two surface openings, between which there is a considerable difference of level, which may be increased by erecting an air-chimney over the higher one. In winter the currents of air are often inconveniently strong, and are therefore diminished by doors which partially shut off the draught.

2. Artificial Ventilation. As the natural ventilation depends on the difference of temperature of the exterior and that in the mines, it may be effectually assisted when it is found insufficient by a furnace placed at the bottom of a shaft, by means of which a brisk draught is created.

Machines for injecting or exhausting air are also employed extensively. *Pl.* 24, *fig.* 35, represents an exhausting engine driven by steam, erected at the mine of Bois de St. Ghislain. The exhausting cylinders have ten feet diameter; they are made of oak staves hooped with iron hoops, their bottoms as well as the pistons are of cast-iron, and have each ten valves which are counterpoised. At each stroke of the engine one of the cylinders exhausts air from the mine while the other is descending freely.

The centrifugal ventilator is also frequently employed in ventilating mines. *Pl.* 26, *figs.* 6 and 7, represent half sections of this apparatus: six curved rings or guides, *a*, *a*, are attached to a disk at the upper end of the vertical axis; on the lower side of the guides is attached the annular disk, *cc*, which lies in the plane of the head of the cylinder, DD, which covers the opening of the shaft. To *cc* is attached a sheet iron cylinder, *ee*, dipping into water contained in a circular trough, *ff*, in order to prevent leakage; the difference in the height of water on both sides of the cylinder, *ee*, is due to the difference of pressure between the exterior air and the interior, which is set in motion by the rotation of the ventilator. *Figs.* 8 and 9 represent a similar apparatus, which revolves on a horizontal axis. *Fig.* 10 is a ventilating screw, which will act either as an exhauster or a blower, according to the direction in which it is turned.

The manner in which the circulation of air to the furthest extent of a mine is insured by regulating its course by means of doors, is shown in *pl.* 23, *fig.* 33. The air comes in at the shaft A, circulates through all the working levels by following the course indicated by the arrows, and escapes again through the shaft B; the dark portions of the figure are exhausted workings which are separated by air-tight partitions. At *a*, *a*, *a*, is shown how the current is guided into the foreheads of the mine. *Fig.* 34 represents another system of working and ventilation, which is in general use in coal-mines. The current descends through the shaft A, and is divided into two parts, which remain separate throughout the whole mine until they unite again near the shaft B, through which the air rushes out; D is a furnace which keeps up the ventilation.

In most mines there are persons whose sole duty it is to examine constantly the state of ventilation. An anemometer, which is frequently used for the purpose of ascertaining the velocity of the air-current, is represented on *pl.* 26, *figs.* 13, 14, and 15, in two side-views and a top-view. To the axis, A, are attached four wings of gold-foil, making an angle of 30° with a plane perpendicular to the axis: an endless screw, V, drives a wheel, R, of 100 cogs, which by a small lever, *c*, moves the wheel R′, having fifty teeth, one tooth for every revolution of R. Thus for 5,000 revolutions of the fans the wheel, R′, makes one; when the axis of the instrument is presented to the draught, the number of revolutions of the fan counted by the indicators, *i*, *i′*, will show the relative velocity of the current.

3. Illumination of Mines. The pit-bottoms only and the straight galleries of transport are lighted by stationary lamps (*pl.* 23, *fig.* 36, the bottom of the engine pit of a Newcastle coal mine). The miners either carry small tallow candles, which when at work are fixed in front of their hats, or oil

lamps suspended from a hook by four chains. Since the invention of Davy's safety lamp it has been universally employed in all mines in which inflammable gas is developed. On *pl.* 26, *fig.* 12 *a*, it is represented; it consists of a common lamp covered with a cylinder of very fine wire gauze, which was found by Davy to interrupt the flame of carburetted hydrogen, unless the air is agitated. An improvement upon Davy's lamp was made by Messrs. Upton and Roberts, by covering it with a glass cylinder in such a manner as to admit the air which feeds the flame only under its bottom, first through holes and next through a disk of wire gauze. The air which surrounds the wire-gauze cylinder will therefore not be set in motion by moving the lamp, or by currents of air. *Figs.* 12, *c*, *b*, *d*, represent this lamp.

Another safety-lamp, invented in 1838 by Dumesnil, is represented in *figs.* 12, *e* and *f*; the oil-reservoir is at the side, the flat wick passes through the cylinder plate, *p*, and air for the flame is supplied at both sides through the tubes, *c c*, covered with wire gauze. The flame is encased in a strong glass cylinder, MM, and at the top is a double chimney with a contracted orifice, but not covered with wire-gauze.

Fig. 11 represents a breathing-tube which is made use of to enter the mines when they are filled with noxious gases, in order to save persons in danger of suffocation. It consists of a tube of cloth or cotton kept open by a wire spiral, and is provided with a mouth-piece fitted closely to the face, which has two valves, one admitting the air from the tube, the other opening outwards when the air is exhaled. With a tube of three quarters of an inch diameter respiration can conveniently be kept up at a distance of 100 feet from the respirable air, and with larger tubes at a greater distance.

8. Transport of Ores to the Surface.

In irregular and short levels the ore is carried on the back of the workmen in bags or convenient vessels. In many mines in France the ore is dragged in a kind of sledge (*pl.* 26, *figs.* 16 and 17) on the floor of the level. In the larger levels wooden or iron tracks are laid, on which the ore is transported in vehicles called dogs or rolleys (*figs.* 19 and 20). Another mode of constructing these cars is seen in *figs.* 21 and 22, each wheel having a separate axle, which affords some advantage on curved tracks. A two-wheeled car (*fig.* 18), with props like a wheelbarrow, is also frequently used.

In working deposits of considerable dip the coals or ores are simply thrown down into the main level of transportation from the upper working levels through planked openings, which are frequently provided with a valve at the lower end, by opening which the cars placed below it will be filled.

When the rolleys cannot be brought to the surface through the gallery, they are unloaded at the bottom of the engine-pit, either by being tilted over or by opening one of the sides of the car, which moves on hinges. The material is then drawn up in buckets or *corves*, the size of which depends

upon the power of the machinery employed to raise them. For raising ore from a moderate depth a common windlass (*pl.* 26, *fig.* 28) may be employed. For greater depths and larger loads horse and steam-power are used. *Fig.* 27 represents the application of a steam-engine for the purpose of raising coals. It works in two shafts at once, the empty corves descending in one while the full ones are coming up in the other. In this way the weight of the material only is required to be overcome by the engine, the descending and ascending corves balancing each other, an arrangement which should always be attended to.

In cases where a mine has a capacious adit, or when material must be introduced to fill up the spaces from which the ore has been removed, the ascent of the corves is caused by the descent of vessels filled with water or rocks; the velocity is regulated by brakes. The same means are employed to draw up the ores on inclined planes, the lower part of one of which is seen in *fig.* 26 *a*, which also shows the manner of loading the car, M M. A dog, G, filled with ore is weighed by an apparatus indicated in the figure, and is then allowed to tilt over and discharge its load into the car, M, by withdrawing the bolts which hold it down to its truck.

Fig. 23 represents a car which is frequently used on inclined planes, *Figs.* 24 *a* and 25 show the usual contrivance for unloading large cars. The last sills of the railroad on which the car runs are movable about pivots, *j*; when the car comes on them, they are held in the horizontal position by the hooks *x* and *y*; after attaching the car by the chains, *c*, and drawing the bolt, *n*, of the end of the car, the hooks, *x* and *y*, are thrown out by means of the lever *d*, when the frame will be tilted by the weight of the car, and the load discharged. It requires but little force to replace the frame afterwards in the horizontal position, when the car will again be on the track.

The descent and ascent of the miners take place on single or double ladders (*pl.* 24, *fig.* 37) on winding stairs (*fig.* 36), in the corves (*fig.* 38), or on an especial seat attached to the rope (*fig.* 39). In France, Belgium, and England, the latter modes are common, but in the Prussian coal mines, in the Hartz, and in Cornwall, the common ladders are in general use, in consequence of which much time and force are spent by the miners in the ascent, more particularly through shafts of a depth of 1,200 to 2,000 feet.

9. Drainage of Mines.

When the workings are above the level of a valley at no great distance, the drainage is generally effected by an adit level, which is a slightly inclined subterraneous canal emptying the waters of the mine near the lowest level of the valley. Such a slope only should be given to it as is just sufficient to make the water run, in order to drain the mine at the lowest possible level. This method of drainage is always the surest where it can be effected, and notwithstanding the great first outlay is generally the most economical.

Whenever the workings are driven below the natural means of drainage, or below the level of the plain, recourse must be had to mechanical power. The water is sometimes raised in buckets or tubs, but most frequently by pumps of various construction. The common suction-pumps are used for inconsiderable depths; for great depths forcing-pumps with hollow pistons or solid plungers are employed, all of which have been fully described in a former article. We add the description of an excellent lifting-pump in the mines of Huelgoet, which is set in motion by a hydraulic engine (*pl.* 26, *fig.* 29). C is the working barrel, closed at the top, but open at the lower end; P is the piston, LL′ the valve-box; when the piston descends, the water ascends through the suction-valve, *s*, into the valve-box and the barrel, and by the upward stroke of the piston it is raised through the lift-valve. Both valves are conical, without any packing. The leather packing of the piston-rod, X, is seen in *fig.* 33; that of the piston, which is a spring-packing, in *figs.* 31 and 34. A small lateral tube, $u' \; u'' \; u'''$, provided with stop-cocks, connects the suction and lifting-pipes and the barrel, and serves to fill the suction-pipe with water when the pump has not been in action for a length of time. A small valve, W, which is loaded with the pressure of one atmosphere, shows at all times whether the suction-valve is in good condition, as, when it does not close perfectly tight, the pressure of the upward stroke will cause the valve, W, to open. *Fig.* 32 shows the joining of the several pieces of the lifting-pipe.

Water containing copperas in solution is injurious to leather packing by rendering it hard. In such cases plungers of solid metal without any packing are to be preferred (*fig.* 30), and in the copper and zinc mines in Cornwall they are generally in use.

Before closing this article we must say a few words about some mines which claim our attention, either by the peculiarity of the mode of working or by their picturesque appearance. Among these are the Swedish mines at Falun and Persberg; of the former we have given an exterior view (*pl.* 23, *fig.* 1), and a view of the great cauldron with the head of the working-shaft (*pl.* 25, *fig.* 2); and of the second the exterior view (*pl.* 23, *fig.* 2) and the interior view of the rock chambers (*pl.* 25, *fig.* 1). The copper mines at Falun and Persberg have long been celebrated, but are now nearly exhausted. In the time of Gustavus Adolphus they yielded yearly over 5,000,000 pounds. The principal entrance, which we have represented, is 240 ft. deep and 60 ft. wide, and was formed by a terrible caving in which occurred in 1687. It was then resolved to suspend the working, but upon a revolt of the miners the labors were resumed.

A singular impression is made upon the beholder by the interior of the mill-stone quarry at Niedermendig on the Rhine (*pl.* 26, *fig.* 2), with its colossal arches and pillars. The quarrying of the stones is quite simple. The hardness of the stone is such that neither masonry nor timbering is required, but immense pillars are occasionally left to support the roof. The stone is blasted in large blocks, which are first worked cylindrical, and split with wedges into disks of the required thickness; the stones are then dressed, the hole is cut, and they are sent up to the surface completed.

The salt mines at Wieliczka (*pl.* 26, *fig.* 1), in Galicia, are justly considered one of the wonders of Europe. They extend not only beneath the town, but also to a considerable distance on each side; and their treasures still appear to be inexhaustible, though they have been worked between five and six centuries.

The depth of these mines is upwards of 2000 ft.; there are eleven openings to the surface, and the aggregate length of all the galleries is said to be over 250 miles. Many exaggerated stories are told of whole families living in the mines and never coming to the surface, but these are entirely without foundation. The workmen are divided into three bands, which relieve each other alternately, spending eight hours of the twenty-four in the mines and the balance above-ground with their families. In 1570 and also in 1614 the mine suffered very much from fire, and since then all timbering has been discarded, the roof being supported upon pillars of rock-salt; the steps are also cut out of the same material. St. Anthony's Chapel, upon the first floor, about 300 ft. from the surface, is also hewn out of the salt rock, as is also the great hall, which contains lustres hanging from the roof and all the curiosities, crystals, petrifactions, &c., which have been found in the mine. The effect of illumination is said to be truly magical in these spacious rooms, and to be enhanced by the varied color of the salt, white, pink, grey, and black.

These mines are supposed to be connected with the salt formation in Walachia, having an extent of upwards of 500 miles.

VIII. METALLURGY.

Metallurgy, equally with other branches of art, requires its own peculiar implements and tools, the most important of which we shall notice in the sequel. As our limits will not permit us to speak of all the metals, we shall select iron, indisputably the most important one, and carry it through the different processes to which it is subjected, from the ore to the merchantable metal.

1. General Preparation of Ores.

Metals, united with other mineral substances, in the form of ores, are found distributed throughout the crust of the earth, and we have seen them extracted therefrom in the foregoing article, by the operations of mining.

Before the final reduction, the ore is more or less separated from foreign substances by mechanical means; this it is not, however, possible perfectly to accomplish, and the further the operation is pushed the greater will be the waste of the ore.

The preparation of the ore commences with the picking or sorting, which

takes place in the mines; and consists in separating those pieces of rock which apparently contain no ore, from those which contain more or less of it.

The richest portions are to be subjected to the dry stamping; the next in grade, which are too rich to be subjected immediately to wet stamping, are first sifted, and thus are made to yield much pure ore. There are, then, two other qualities of ore distinguished, which are subjected to wet stamping and sifting.

Sifting serves to separate the rich ore from the fragments of sterile rock, the whole having first been subjected to stamping, either wet or dry, and to distribute and separate the ores in the order of the coarseness of the grain. The sieves are plunged into vessels of water, and violently agitated by a series of up and down motions, and thus the mineral substances are raised up and fall nearly in the order of their specific gravity, the metallic portions sinking to the bottom; those particles which pass through the meshes of the riddles settle at the bottom of the vessel, and are afterwards exposed to washing, when they are worth the trouble.

The powdering of the ores is performed in stamping-mills. The stamps are raised by wipers or cams on a revolving-shaft, and are permitted to fall upon the material in troughs; the stamps are shod with iron at their lower ends, and weigh from two to three hundred pounds (*pl.* 27, *fig.* 21). A stream of water passes constantly through the trough, and the pounded ore passes with the water immediately to a series of shallow receivers united by channels; the richest portions of the ore, being heaviest, settle nearest to the stamping-trough, and the lighter particles next, until the water arrives at the last receiver, where the lightest particles are thrown down.

2. Roasting.

The ore prepared as above is submitted to another operation, called *roasting*, before coming to the furnaces.

Iron ore, which requires only to be pulverized to assist its melting, is roasted to render it friable, and disengage its water and carbonic acid. Sulphur, antimony, and arsenic are also volatilized by the process of roasting, and by their union with the atmosphere various products are formed. At a low temperature sulphates are formed, which, as the heat is elevated, yield sulphuric acid gas; the metallic oxides remain behind.

3. Furnaces.

The different furnaces made use of in metallurgic operations may be divided, according to their construction, into *open furnaces*, *stack furnaces*, *reverberatory furnaces*, and *crucible furnaces*. In the two first classes the fuel is mixed with the ore; in the third, only the flame operates upon it; and in the fourth, the material to be heated is inclosed in crucibles, which are exposed either to immediate contact with the fuel or to its flame. In some

of these furnaces a blast of air is used to urge the fire, and increase the heat.

1. Open Furnaces. Open furnaces are the simplest used in metallurgic operations. *Pl.* 27, *fig.* 1, is an example, in which the walls are but 2 or 3 feet high; strictly, this should be considered as several furnaces, with division walls between them. The roasting of minerals is performed in these furnaces in the following manner: The floor is covered with a layer of fuel, upon which the ore is placed and the fuel is lighted. Those ores containing sulphur and bitumen require but little fuel, as when once heated to a certain point they take fire and burn of themselves. Others, as iron ores, which contain no combustible matter, require considerable fuel to effect the roasting. Ores are often roasted in pits in the earth, in which case a high and dry locality must be chosen; frequently the operation is performed in heaps in the open air, which is often considered the most available method. *Pl.* 27, *fig.* 2, shows the liquation furnace used for separating silver from lead ores; the walls, *a*, are inclined towards each other, and on the top are covered with plates of iron, which leave narrow openings between them, their whole length. The material to be operated upon is placed upon the inclined plates, and the fuel beneath and all around it; the lead, as it melts, drops through the openings between the plates, and collects in the receptacle *b*. *Figs.* 3, 4, and 5, represent a blomary or forge-fire for the reviving of iron; it consists of low masonry work, with an excavation in the hearth, to contain the metal to be operated upon. *Fig.* 3, *a b c d* are four cast-iron plates, the bottom of the hearth forming a fifth; *e* is the opening through which the tuyere passes; three or four inches above the bottom of the hearth is a row of holes or a slit to let off the cinders. The hearth and tuyere are hollow, and water is kept circulating through them. An open copper furnace, seen in *fig.* 6, differs from the blomary principally in having a spherical hearth; *a* is the crucible. The masonry, which partially surrounds the hearth, is for the purpose of better concentrating the fire; *b* is the tuyere; *c*, the black wall through which the tuyere passes; *d*, a partition wall dividing the space above the hearth.

Pl. 27, *fig.* 7, is a view of an open silver refining furnace; *a*, the opening for the tuyere; *b*, the cupel crucibles. The cupel consists of a crucible of iron, in which the wood and bone ashes are rammed, on the surface of which is a depression for receiving the silver which is to be refined.

2. Stack Furnaces. The signification of the word *stack* sufficiently explains the general character of this class of furnace, the interior space being open at the top, and entirely closed with masonry, forming a shaft or stack which receives the material to be heated, either alone or mixed with the fuel, the atmosphere necessary to combustion being supplied at the bottom, either by the draught or by a blowing apparatus; those operated by draught alone are used for roasting only. *Pl.* 27, *figs.* 11^a and 11^b, are vertical sections, at right angles to each other, of a Swedish furnace of this description; *a* is the stack which is to be filled with the material to be operated upon; *d* is the fire space, at the bottom of which is a grate; *e* the ash-pit. The fire space is covered with massive iron bars, laid close to each

other, which, however, permit the flame to pass through. *b*, the openings from which the ore is withdrawn as it is roasted; *g*, inclined iron plates, over which the iron is withdrawn from the furnace. The ore to be roasted is supplied from above, at the top of the stack. *f* are openings in the ash-pit, to supply draught and for the withdrawal of ashes.

Fig. 8^a is a vertical and *fig.* 8^b a horizontal section of a furnace for roasting iron ore; *a* is the shaft, lined with fire-proof stone; *b* is the grate. The roasted ore is withdrawn at the openings, *c*, into the spaces, *e*, and thence to the arched chambers, *f; d* is the ash-pit. The operation in this furnace is continual, the material being constantly supplied at top, and withdrawn below as it is roasted.

Pl. 27, *figs.* 9^a and 9^b are sections of an ellipsoidal furnace for roasting iron ore; *b'* are three fire doors; below each grate is an ash-pit, *d; c* are openings for withdrawing the ore.

All stack furnaces used for the purpose of smelting metals, and which require a high heat, are furnished with a blowing apparatus; they may be divided into *blast furnaces* and *blue ovens.*

Fig. 10^a is a vertical section and *fig.* 10^b a horizontal section of an iron blast furnace; *a* is the shaft; *b* the boshes; *c* the crucible; C and D are the tuyeres, of which there may be one, two, or three; *e* is the hearth-pit, where the melted iron collects; *g* is the dam-stone, which closes the hearth-pit, except at a single point, which is closed with clay, through which an opening is made to let off the melted iron; *f* the timpstone, which is protected by the timp-plate, imbedded in fire-clay. The upper portion of the stack is seen at 10^c, above *fig.* 7. *h* is the fauld-plate, over which the cinder is run out; A is the working side, B the back, C and D the blast sides of the furnace. At *fig.* 20 are seen the tuyere chambers. Every part of the wall exposed to a strong heat is constructed of fire-proof stone.

Pl. 28, *figs.* 1^a, 1^b, are sections of a blast furnace, through the dam-stone and hearth, upon a large scale. The stones *a* rest upon a layer of sand, *p*, and form the hearth; beneath the sand is an iron plate, *o*, and beneath the plate is the air passage, *q;* the cheek stones, *b*, the back stone, *c*, and the dam-stone, *d*, form the walls of the hearth-pit; *f* is the timp-iron, *g* the timp-plate, *e* the timp-stone; *h* and *i* are the tuyere stones, *k k* iron plates to support the wall above; *l l* are the wall stones between the timp-stone and boshes, *m* the openings for the tuyeres. *Pl.* 27, *fig.* 19, is an interior view of a blast furnace house in the department Aveyron. *Fig.* 12 is a so-called *blue oven,* which is worked with a closed breast, and has an opening below to let off the iron and cinders; *a* is the shaft, *b* arched openings through which enter the blast tubes; *e* is an opening which, when the furnace is in operation, is walled up as high at the tap hole. When the furnace is started the breast is closed, with the exception of a hole at the bottom to let out the iron, and a hole six or eight inches above the first through which the cinder flows out; it is filled to the top with coal and iron, the supply of which is renewed as the charges sink. This furnace is kept in continuous blast for three, six, or nine months.

Pl. 27, *figs.* 13^a, 13^b, and 13^c, represent a crucible furnace with closed

breast; *a* is the shaft, *b* the crucible for the metal and slag. The sole, *d*, consists of cement, and rises towards the tuyere opening at the back.

Figs. 14^a and 14^b are sections of a furnace in use at the Falun copper works. The shaft terminates in the sink in the clay at *f;* the fore-hearth in front of the breast-opening, *k*, communicates by a canal with the crucible *o*. The layer, *e*, is firmly rammed clay, *d* cinders, *m* iron plates in front of the hearth.

There are also blast-furnaces from which the iron runs uninterruptedly through the tap-hole, which is never closed. *Pl.* 28, *fig.* 2^a, is a furnace of this description, constructed something like the German blue oven. *a* is the shaft, *c* the crucibles into which the metal flows, *e* the openings for the tuyere.

3. Reverberatory Furnaces. Those furnaces in which the fuel does not come in contact with the metal, but operates upon it by its flame, are called reverberatory or puddling furnaces. In furnaces of this description the ore is placed upon a level or concave hearth, and the walls and arch are so constructed as to throw back the flame upon the metal to be melted. In *pl.* 28, *figs.* 3^a, 3^b, 3^c, and 3^d, is represented a double roasting furnace on the reverberatory plan, in which there are two hearths one above the other, *h* and *h'*. This furnace may be used in two different ways: either each hearth may be used with its separate blast, or the blast may be applied to the lower hearth only, passing thence with the stream of hot gases to the upper one. In the former case the smoke passage, *f*, is closed with an iron plate, and the smoke passes immediately to the chamber x, and the double roasting furnace performs the functions of two reverberatory furnaces, with this difference, however, that the upper one is easier to heat. Where it is used as a double roasting furnace, the passage *f* is opened and there is but one fire, viz. upon the grate *r;* the upper hearth then serves for preparatory roasting and the latter for finishing the operation. The working openings, *o* and *o'*, are upon opposite sides of the furnace, that two laborers may be employed at the same time without interrupting each other.

Pl. 27, *figs.* 15^a, 15^b, 15^c, represent a puddling-furnace used for converting cast-iron into wrought-iron; *a* is the ash-pit, *r* the grate, *b* the fire-bridge, *h* the hearth upon which the pig metal is placed. The bridges *b* and *d* are hollow, having each in its centre a cast-iron pipe through which a stream of water is kept constantly running; *l* is an opening beneath the chimney, through which ashes which collect there may be withdrawn; *t* are cast-iron columns which support the stack. Beneath the hearth is an open space, and the openings, x, are for the purpose of giving access to the same.

4. Crucible-Furnaces. Those furnaces in which the substances to be acted upon are confined in a crucible which is exposed to the action of the fire, are called crucible-furnaces. Their construction is very various, according to the use to which they are to be applied. Of this class are muffle-furnaces made use of for various metallurgic processes, in which the material is to be kept from immediate contact with the fire. *Pl.* 28, *figs.* 7^a, 7^b, represent a furnace for roasting or distilling arsenic with muffle-formed chamber. A is the ash-pit, B the grate, D the hearth of a double layer of fire-

bricks upon which the finely stamped arsenic mineral is spread. The fire passes from the grate beneath the hearth out at the opening, *q*, thence back through the channels, *i*, to the double chimney, *g*, and thus the flat muffle-formed space above the hearth is heated without bringing the flame into contact with the arsenic, and the arsenic acid passes by the passage, *h*, to the condensing-chamber. Whilst the furnace is in operation a second charge is being warmed upon the top of the furnace, and is fed to the muffle at the hole, *e*.

Crucible-furnaces, which serve simply for melting, are of the simplest construction. *Pl.* 28, *figs.* 8^a and 8^b, is a Sefstrom furnace, and consists of two cylinders of sheet-metal so united by the ring, *e*, as to leave a vacant space between them. The interior cylinder is lined with fire-clay, and there is also a support of the same material for the crucible; at *a* is an opening for the entrance of the blast, which passes through a circle of holes, *b*, to the fire on every side.

For handling the crucibles in this and other similar furnaces, the tongs shown in *pl.* 27, *figs.* 17 and 18, and *pl.* 26, *figs.* 9 and 10, are used. *Pl.* 28, *figs.* 6^a and 6^b, represent an English muffle of sheet-iron lined with fire-clay; *a* is the fire space, *c* the fire grate, *e* the fire door. The box, *d*, in the space, *b*, is the muffle.

Fig. 5^a is a longitudinal section, and 5^b a transverse section of a muffle-furnace used for burning enamels and colors upon porcelain and glass; *a* is the ash pit through which the draught passes to the fire; *b* is the fuel; *g* the grate. The muffle, *h*, is shoved into the furnace from front. When the operation is completed the chimney is closed at *d*, and the whole permitted to cool gradually.

Sand-baths are another species of furnace of this general character. They are used where materials are to be warmed or heated to a moderate degree without coming in contact with the fire, for which purpose the vessels which contain them or the substances themselves are buried in the sand, or simply laid upon its surface. *Pl.* 28, *figs.* 4^a and 4^b, represent a sand-bath-furnace, in which *a* is the ash-pit, *f* the grate, *b* the fire space, *h* the fire door; behind the fire space is a bridge over which the flame and smoke pass to the chimney, *c*, which may be closed by the plate, *d*, to regulate the cooling of the sand-bath. Over the fire space is a cast-iron plate, and upon this a frame, *i*, which supports the sand-bath.

4. Chemical Metallurgic Apparatus.

The apparatus used in the chemical processes of metallurgy are the same as those required for this branch in the laboratory, modified only by the amount of materials operated upon in each case. As an example, however, of the difference which occurs in the construction of some of the apparatus, we will present the amalgam mill (*pl.* 27, *fig.* 16) used for extracting gold from auriferous sand. As but a portion of the metal can be extracted from the sand by a single mill, it is usual to unite several of them together,

that the gold sand carried by the water from one mill may be conveyed to the other. Two such machines are seen together in the drawing. *a* is the mill-basin secured to the frame, *h*, and having a hollow tube in its centre through which the shaft, *d*, driven by the wheel, *g*, of the runner, turns. Upon the top of the shaft, *d*, is a cross-bar, *b*, which is connected with the runner by two arms; in the centre of the runner is a funnel-formed opening which receives the stream of water and sand, which in its passage beneath the runner is brought into contact with the quicksilver at the bottom of the basin *a*, which is also kept in motion by iron plates upon the bottom of the runner, and which amalgamates with a portion of the gold, the sand and water passing on to a similar mill where the process is continued.

5. Working Iron.

No metal is of so great importance to man as iron; on this account we have selected it to give a rather detailed description of its manufacture. As it leaves the furnace after the operation of smelting, it is known as raw-iron or pig-iron, of which two kinds are distinguished, white-iron and grey; the former has a silver white color, and is used in the manufacture of steel; the latter is of every shade, from black to light grey. Wrought-iron is of a light grey fracture, running partly into white, partly into grey. Steel has a greyish white fracture, is harder than iron, and is worked with more difficulty.

We have already spoken of the furnaces made use of in extracting iron from the ore, and will now say a few words upon the process itself. The ore having been broken into small pieces and roasted, is ready for the smelting process, which reduces the oxygen and separates the compounds of silicic acid in the form of slag. Charcoal, stone coal, or turf, may be used according as they are to be obtained to advantage.

The furnace is first slowly heated, to prevent it from cracking, and is then charged lightly with coal and ore alternately. When the first traces of metal show themselves the crucible is cleaned, the tap hole closed, and the blast is let on, lightly at first, and gradually increased for five or six days, when it has its full power. The labors of the blast-furnace then consist in renewing the supply of ore and coal from time to time, and keeping the furnace free of slag.

When sufficient metal has collected in the crucible, the tap hole is opened and it is suffered to run off; in blast-furnaces with open breast this takes place every twelve, eighteen, or twenty-four hours; the tap hole is then cleaned out and again closed.

Within the last twenty years many experiments have been made with *hot-blast-furnaces;* in these the blast is heated before it is supplied to the furnace. Many methods have been adopted for effecting this purpose; sometimes the air is heated in separate furnaces, at others the waste heat from the furnace itself is employed; generally it is made to pass through heated cast-iron pipes, the convolutions of which are surrounded by fire; at others it is accomplished in air-tight chambers (*pl.* 28, *fig.* 11).

Wrought-iron is produced immediately from the ore or from pig-iron; in the former case, where the blomary fire is made use of, the iron ore, roasted or not, is mixed with coals, and melted down upon an open hearth under a blast produced by bellows of the common form, or more generally by wooden cylinders urged by water-wheels.

The production of wrought-iron from pig metal is accomplished in finery fires, or puddling furnaces. In finery fires the metal is partially melted under the blast, and the carbon and foreign substances measurably expelled before it is taken to the squeezers.

The puddling-furnace is undeniably the best adapted for converting pig-iron into bar-iron. The iron hearth of the furnace already described is covered to a depth of three or four inches with cinders from a charcoal forge, from another puddling-furnace, or from a re-heating-furnace. If none of these can be obtained, cinder from a blast-furnace will answer. The furnace is then fired, and when the cinder is melted, and the bottom and sides are properly protected, cold cinder is thrown in; and when the bottom is so far cooled that the tools make no impression on it, the iron is charged. As the latter begins to get red it is turned and worked over, and as it becomes white and commences to melt, it is broken with hook-formed instruments, and mixed with the partially melted cinder; after a further heat it is divided into lumps twelve or fifteen inches in diameter, and carried to the hammer or squeezers. These lumps, called balls, are then subjected to the operation of *shingling,* which is performed under the hammer or in the squeezers, and which converts them into blooms or more regularly formed masses; these blooms then pass to the rough rollers. Sometimes no hammer or squeezers are employed, but the balls are taken directly from the puddling-furnace to the rollers. The roughing rollers take the bloom and reduce it into billets of a size proportioned to that of the bars to be drawn. The rollers for the final preparation of the iron are seen in *pl.* 28, *figs.* 12^a, 12^b, and 12^c; *fig.* 13 represents them in plan; *figs.* 14 and 15, cross-sections; *fig.* 16, the cog-wheel driving the rollers; *fig.* 17, a front view of a sheet-iron rolling machine; *fig.* 18, a view from above, and *figs.* 19 and 20, details of the same; *fig.* 21 shows the operation of rolling; and *fig.* 22, the cutting off of railroad rails by circular saws. The rollers are set in strong cast-iron frames, and are adjustable more or less near each other by screws; they are furnished with round or angular grooves according to the size of iron to be rolled.

After the balls are prepared in the puddling-furnace they are carried in the tongs (*fig.* 10) to the hammer, or, where no hammer is used, to the first set of rough rollers (*figs.* 12^a and 14), where they are drawn into billets or plates. The hammer is, however, to be preferred, as the cinder falls freer and the welding is more perfect.

The iron thus prepared either by hammering or by passing many times through the rough rollers, is cut, bound into parcels, re-heated, and taken to the finishing rollers.

Sheet-iron is made directly from the bloom upon the rollers (*figs.* 17 and 18), which are made to approach each other slightly after each passage of

the iron, by means of the set screws moving the upper rollers; the iron is repeatedly heated during the operation, which is continued until the sheet is reduced to the required thickness.

IX. AGRICULTURE.

Agriculture is that art by which the earth is rendered capable of ministering to our necessities. It treats of the growth of plants and animals, as mutually dependent branches, the latter being always founded upon the former. Its legitimate aim is not the production of the largest and finest animals, the heaviest crop without regard to cost, but the reaping from a certain capital the surest heaviest income.

Agriculture may be taught or studied in three different ways: as a trade or mechanically, as an art, and as a science. Mechanically considered, agriculture does not differ from other trades, and consists in the imitation of practice and the exercise of judgment. As an art it takes a wider range, and follows fixed rules and precepts, which are the result of long-continued observations upon nature. So long as these rules are founded upon nature, they are of value; but in most cases they spring from isolated observations, are not in accordance with first principles, and are unworthy of confidence.

The insufficiency of such rules, without distinction of cause and effect, is never more apparent than in the case of an agriculturist who has followed them with advantage in one district, and who, when he moves to another of different character, finds they but mislead and deceive him.

Science, on the contrary, fixes no positive rules, but developes the principles to be followed in every variety of case that may arise, teaches us to dive to the bottom of nature's springs for the foundation stones of a rational theory, and is in fact itself the only true basis on which a system of agriculture can be erected. Theory alone, however, can never make an agriculturist, but only when hand in hand with practice.

1. Tillage.

A. The Soil.

The surface of the earth, the grand workshop of the vegetable kingdom, produces everywhere, when left to itself, those plants to the growth of which the soil and climate are congenial. The original elements of the soil, silex or sand, clay, lime, and iron, now one now the other preponderating, constitute, as it were, the vessel in which is prepared the food necessary for the growth of plants and in which it is offered to their roots.

These elements impart certain qualities to the soil, according as they preponderate, one producing a light, dry soil, with but little power of retaining moisture; another, a close, moist soil, having strong affinity for water, and retaining it for a great length of time. A certain medium between the two

extremes, to a depth of nine to twelve inches, is most favorable to the growth of cultivated plants. In general the greater the preponderance of sand the lighter and more easily moved is the soil, while a preponderance of clay gives it exactly opposite qualities.

The food of plants consists of water and the remains of decayed vegetable bodies, which in the state in which it is found in the soil is called *humus*. Soils may be divided into, 1. *very stiff clay;* 2. *moderately stiff clay;* 3. *sandy clay;* 4. *moist, fine-grained, sandy soil;* 5. *dry, coarse-grained sand.*

1. Stiff Clay is in best condition when, either by nature or liberal treatment with manure, it contains a rich supply of humus, or when the decomposition of the humus has been effected by cultivation which has brought every portion of the soil in contact with the atmosphere, and which at the same time has eradicated the weeds. As such soils, however, on account of their impermeability, are liable to suffer from an excess of moisture, care is necessary that good water-furrows be provided to carry off superfluous water, which otherwise might stand in pools upon the surface. Attention to this is important to the prosperity of every plant, but indispensably necessary to the growth of the cereals.

2. Moderately Stiff Clay or Clay Loam. In general, what has been said of stiff clay holds good of this soil also; it is, however, easier to work, suffers less from moisture, and thus is better adapted to the growth of grain. On the other hand, it is more easily deprived of its humus by a succession of crops; but by the admixture of lime the assimilation of its elements is promoted, and even when there is a lack of humus, with favorable weather, good crops may be expected.

Each of these grades of soil is, however, easily baked or hardened upon the surface by the sun: on this account a covering of vegetation is of great importance to the development of the strength of the soil.

3. Sandy Clay or Sandy Loam. This soil permits the ready entrance of the air, and in consequence its cultivation presents comparatively few difficulties; its natural products, weeds, require a corresponding greater degree of care. This soil may be said to be in the best order when the manure applied to small grains is decomposed and mixed with the earth. Care is requisite to retain the surface water instead of leading it off, and to compact the soil during its cultivation by the use of the roller. Furthermore the ready access given to the atmosphere causes a constant decomposition of its humus and manure until interrupted by frost, and consequently such soils should never be left without some growing crop. On this account such land should not be fallowed, as the air thus carries off its useful gases and the soil soon becomes sterile.

4. Moist, Fine-Grained, Sandy Soil. The peculiarity of this soil consists in the extreme fineness of its sand, which exists in a state of dust so minutely divided as to resist the entrance of the air to an equal degree with those soils containing too much clay. Water is thus prevented from escaping, and weeds grow with great luxuriance. The sun hardens this soil so as to render ploughing extremely difficult, and the atmosphere is completely

excluded. This so-called *cold soil* must be so managed in cultivation as to destroy knot-grass, charlock, and other weeds which are apt to infest it, and to forward the decomposition of its humus. This is accomplished not so much by fallow as by cultivation in hills upon long manure. Potatoes and garden vegetables, when used for food, are not so well adapted to the purpose, as the coldness of the soil retards them, and they flourish only in very warm days. Naked fallows evaporate the gases which should nourish vegetation. As this soil also suffers from too much moisture, the *lands* should be laid off narrow and the furrows be well cleaned out, particularly for winter grain.

5. Dry, Coarse-Grained, Sandy Soil. This is the direct opposite in all respects of clay soil, and must be managed in an entirely different manner. If in the latter the entrance of the atmosphere is resisted, in the case before us it is too much encouraged, and the ceaseless evaporation may impoverish the soil before it has borne a single crop. This soil is only fit for grain when it can be shaded by a heavy cover of foliage, which impedes the evaporation of the gases. Its weeds are eradicated by leaving it for many years in meadow, when they are prevented from perfecting their seed, and thus ultimately are extinguished; even knot-grass, the worst and most troublesome of all weeds, cannot endure many years after the ground is laid down to meadow. As with the soils in which clay predominates care is not necessary to conduct off superfluous water, in this case every means must be resorted to, to retain the moisture for the use of vegetation. Neither land nor water furrows are necessary, and the roller must be used with every crop, to compact and consolidate the soil as much as possible.

This classification of soils is important only so far as the decomposition of humus and the growth of weeds are concerned; thus far it is sufficient. A classification as regards fertility requires that other attendant circumstances be noticed, as the subsoil, the character of the surface (whether flat, rolling, or otherwise), and the presence of other chemical and mineral substances. The knowledge of soils thus classified is taught by *Agronomy*, which treats of the different elements of soils and the relation they bear to each other.

There are also exterior signs to be noticed in judging of soils. Their tenacity, as manifested in ploughing and harrowing; its excess in one case, while it is entirely wanting in another; their different powers of absorption and retention of moisture; their color when wet, and their peculiar odor indicating the presence or the absence of humus.

We will now turn our attention to some of the most common agricultural tools.

B. Agricultural Tools.

1. The Plough. Ploughing serves to open the soil for the admission of air and moisture to the organic matter which it contains, and which is thus decomposed and fitted to serve as food for vegetation. The operation is more or less necessary, more or less difficult, according as the soil is stiff and tenacious, or loose and porous. Another object to be accomplished by

ploughing is, the destruction of weeds, which are turned under with the surface soil, and covered with the layer immediately beneath it, which is brought up in contact with the atmosphere and laid in narrow parallel ridges. This turning up and separating from the subsoil is performed by a sharp horizontal plate of iron called the *share;* the dividing into narrow ridges is the work of a vertical iron called the *coulter;* and the turning over is done by a board shaped for the purpose, called the *mould-board.* Every plough consists of these three elements, arranged in proper order, the coulter preceding the share and mould-board. Ploughs may be divided into two great classes: those with wheels, called *wheel-ploughs*, and those without, called *swing-ploughs.*

In *pl.* 29 ploughs of different construction and for various purposes are represented. *Fig.* 1 is a swing-plough in use in Belgium, the share and mould-board of cast-iron, and forming an uninterrupted and continuous curve; *fig.* 2 is a Brabant plough, also of cast-iron, which runs very steadily and may be set to cut deep or shallow, narrow or wide furrows; *fig.* 3 is a Flanders cultivating plough; *fig.* 4 is a Belgian plough, used for breaking up sod-land; *fig.* 5 is a Bohemian plough; *fig.* 6 is a form of subsoil plough or deepener, for increasing the depth of the soil and moving the subsoil; *fig.* 7 is a shovel plough, for cultivating growing crops; *fig.* 8 is a small plough, used also for cultivating and hilling potatoes and other crops; *fig.* 9 represents a plough so arranged as to keep the furrows without the aid of the ploughman; *fig.* 10 is an old Thuringian plough; *fig.* 11 is the so-called champion plough, with the guide wheels of unequal diameter, the right wheel running in the furrows; *figs.* 12 and 13 are right and left hand views of a German plough, which nearly resembles the Belgian; *fig.* 14 is a simple form of subsoil plough, which breaks up the subsoil without bringing it to the surface; *fig.* 15 is a hand plough, for working between the rows of seed beds; *fig.* 16 is a plough with wheels behind the sole, to diminish the friction upon the subsoil; *fig.* 17 is a light plough, used for covering stubble before winter.

In no part of the world, perhaps, have the mechanics of agriculture made such rapid advancement as in the United States. The plough has been made much lighter and of easier draught, whilst its cost has been materially lessened. Amongst others an ingenious instrument has been invented for digging potatoes, which promises to be a great labor-saving machine. Improvements have also been made in ploughs for cultivating upon the sides of hills, and in the common cultivator.

2. The Harrow. The object of the harrow is three-fold: more completely to pulverize the ground after it is left by the plough, to eradicate and destroy the roots of weeds and grass, and to cover seed when sown broad-cast. It consists of a strong wooden frame filled with wooden or iron pins, each of which as the harrow is moved makes a small furrow, or breaks the clods it may encounter.

Pl. 29, *figs.* 18 and 19, are old forms of the Scotch harrow, with horizontal and oblique teeth; *fig.* 20 is a harrow with hooked teeth, for the purpose of eradicating weeds and grass; *fig.* 21 is a form of cultivating

harrows invented in Saxony, for working between the rows of crops; *fig.* 23 is a Norwegian harrow, as improved in England; *fig.* 22 is the so-called English extirpator, which nearly resembles the cultivator in common use all over the United States.

3. Sowing and Planting Machines. Many machines have been devised for planting and sowing, which differ essentially from each other, according to the nature of the seed they are intended to plant. *Pl.* 29, *figs.* 32 and 33, are instruments used in the preparation of the ground; *fig.* 28 represents a simple instrument used for marking the lines in which to deposit those seeds planted by hand, and may be drawn forwards either by the hand or by an animal; *figs.* 34 and 35 are instruments for transplanting.

Sowing machines were first invented in Germany about the middle of the 17th century; since then they have been much improved in England and the United States. With nearly every machine for this purpose is united one or more small ploughs, to open the furrows, in which the seed is regularly distributed; they are so arranged that they may be placed to run deeper or more shallow, according to the nature of the seed to be planted, and to cut the furrows at such a width as may be required. There is also some arrangement attached to most of them for covering the seed. That portion of the apparatus which strews the seeds in the drills generally consists of a series of tubes reaching almost to the ground. Into these tubes the seed falls from a cylinder filled with holes, or is thrown in by small scoops upon an axis made to revolve in the seed-hopper; they are so arranged as to be adjustable more or less near to each other, and receive a slight shaking motion to secure the passage of the seed. In a seed-sower represented in *fig.* 30 the seed is fed to the funnel by a revolving cylinder, and there is an arrangement to stop the feed when the machine is turned. Hornly's seed-planter, seen in *fig.* 36, is intended to sow all kinds of small grain, as also to distribute dry or liquid manure; it has ten seed-tubes, with the same number of ploughs or drills. The furrows are opened at the required distance apart, the seeds are dropped in them either continuously or at proper distances, and immediately covered. *Fig.* 29 is a more simple machine for drilling beans, which are dropped at certain required distances from each other; *fig.* 31 is a machine used for sowing clover-seed, and consists of a series of short perforated cylinders from which the seed is distributed with great regularity as it is drawn along the ground; this is said to be a labor and seed-saving machine, which performs its work well. *Fig.* 27 is a simple machine for drilling turnips, in which the feed-roller receives motion by a band from the axis of the machine.

When seed is sown by hand it is covered by a drag seen in *fig.* 24. *Fig.* 25 is an instrument for the same purpose, which leaves the surface very smooth, and may be loaded with stones to increase the pressure. *Fig.* 26 is the common roller sometimes used when the field has been well harrowed, to cover the seed.

C. Grain Crops.

After the grain is cut it is bound into sheaves and put up in shocks

(*fig.* 39), and when sufficiently dry it is stored in stacks or barns. These stacks are so formed as to shed the rain, and are thatched with long straw, the more effectually to exclude the rain. *Pl.* 30, *figs.* 25 and 26, are common forms, the former as put up in Germany, the latter in England. Before the general introduction of threshing machines, the grain was beaten out upon a threshing-floor, generally formed in the barn itself. The threshing-floor was prepared by first covering it with stiff clay, which was moistened, trodden, and beaten; when dry it was wet with bullocks' blood, and after further beatings, suffered to harden. *Pl.* 30, *fig.* 32, shows an English grain-barn and threshing-floor beneath the same roof. *Fig.* 33, another arrangement of the same with corn-loft, potatoe-bin, and tool-house added. Movable grain-barns are sometimes made use of, which are brought up to the side of the stack which is to be threshed (*pl.* 30, *fig.* 34). In most parts of Europe grain is still threshed by hand with the flail; in the United States threshing-machines are in almost general use for the purpose, and usually consist of a cylinder of wood or iron, studded with teeth, which revolves rapidly within a concave also filled with teeth, so arranged that the rows of teeth on the cylinder fall into the spaces between the teeth upon the concave; the grain being fed into this machine is carried round by the cylinder and violently beaten between its teeth and those of the concave, and the grain thus threshed falls out at one end of the machine, while the straw is carried out at the other end by the centrifugal action of the cylinder and the draught which it occasions.

Where the grain is threshed by hand it is much mixed with chaff and the dust of the threshing-floor; to separate it from these it is passed through the *winnowing machine* or *fan* (*pl.* 29, *figs.* 37 and 38). The grain is put into the hopper, *h*, from which it is delivered gradually upon a vibrating sieve which permits the grain, but not the larger pieces of straw, to pass through; it then descends into the inclined board, *k*, to the back of the machine, whilst the dust and lighter particles of chaff are blown out at the other end by the revolving blower or fan, *d*, *e*, *f*, *g*.

In some parts of Europe grain intended for grinding is first coarsely broken up on a mill seen in *pl.* 29, *fig.* 40, in which the grain is crushed between revolving rollers.

When the straw, after the grain is threshed out, is used for feeding, it is first cut into short lengths, the better to be mixed with the grain or other food used with it. This is performed upon the straw-cutter. Upon small farms this machine consists of a trough three to four feet in length, through which the straw is fed beneath the edge of a knife worked by hand. On larger establishments more effective machines are in use; in one represented in *pl.* 29, *fig.* 41, the knives are secured to the arms of a fly-wheel, which is made to revolve rapidly and thus cut the straw as it is fed from the end of the trough.

Before we proceed further it may be well to say something upon the preservation of the various products of the farm.

In some parts of Europe many kinds of grain are kiln-dried before being threshed. *Pl.* 30, *figs.* 40 and 41, show an arrangement used for this purpose. The same building contains the threshing-floor, the stove, and the

shelves for the sheaves of grain which are replenished from the stacks without continually, as the grain is threshed.

D. Root and Fruit Crops.

Root crops, such as potatoes, turnips, and the like, are preserved in cellars or in holes in the ground, or even, where the cold is not too severe, in heaps raised above the surface and covered with earth. *Pl.* 30, *figs.* 31 *a* and 31 *c*, represent such an arrangement. The roots are heaped and covered first with straw, then earth to a depth sufficient to exclude the frost; in the centre of the heap is a hole usually filled with straw, in which a thermometer (*fig.* 24) is placed. This thermometer is occasionally examined, that frost and fermentation may be guarded against; sometimes the roots are heaped upon the surface covered with light frames (*fig.* 31 *b*), and then with straw, the ends being filled with straw that access may be had to the roots. Clover hay requires peculiar management, otherwise the leaves fall from the stalks and its value is diminished. It should be mowed when a majority of flower-heads are developed, and left one day in the swath. The next day the swaths are to be turned so that two fall together; it is then left until nearly dry, and when the stems on being bent cease to show any moisture, it is gathered in when the dew is upon it. Upon the continent of Europe it is sometimes cured upon frames made for the purpose, called clover-horses (*pl.* 30, *fig.* 27). *Fig.* 28 is also a form of frame used for the same purpose, the object in both cases being to secure a free ventilation amongst the clover, which is arranged with the flower heads inside, that they may not suffer so much from the rain.

The drying of fruit can only be performed in dry weather, when this is done in the open air. When it is carried on upon a large scale, kilns built for the purpose become necessary. In *pl.* 30, *fig.* 35, is a plan of such a kiln, on the line, GH, of *fig.* 36; *fig.* 36, a vertical section upon the line, RS, of *fig.* 38; *fig.* 37, a transverse section on the line, GL, in *fig.* 38; *fig.* 38, a horizontal section on the line, GH, in *fig.* 36; and *fig.* 39 is a perspective view of one of the sliding frames for holding the fruit. Beneath the drying chamber is an oven, and at *m* are openings for the entrance of air which passes through tubes, *x*, to the fruit-chamber, and is again drawn off by the tube, L, and carried beneath the fire-grate to save fuel, and to increase the draught in the drying-chamber.

E. Under-Ground Drains.

When from the nature of the subsoil an excess of moisture exists in the soil, excluding the atmosphere, the evil must be corrected by under-ground drainage. Soils of this moist, cold nature, are unsuited to the growth of any cultivated plants, though particularly congenial to that of weeds. Surface draining does not accomplish the desired end; indeed this can only be effected by deep under-ground drains, which, lying beneath the surface, collect the water from a considerable distance, whilst the cultivation of the ground is not inte rupted.

The first thing to be attended to in laying out drains is to give them a

sufficient fall or descent to carry off the water which collects in them. The operation commences with the construction of a main drain through the lowest portion of the field, to receive and carry off the contributions of the minor drains. This main drain is best left open, and in general should be at least three feet wide at the bottom, and three feet deep; from this radiate over the whole surface of the ground to be drained, the under-ground branches, which, having been dug to the requisite depth, are filled with stones, bushes, straw, reeds, or similar substances, as they may be at hand.

If stones be made use of, care should be taken that none are so large as to fill alone the bottom of the drain; in general the stones should lie hollow, so as to permit the passage of the water, and not dam it up at any one point. *Pl.* 30, *fig.* 29, is not an unusual arrangement, the drain being covered first with a layer of straw, rushes, &c., then with the soil. Where reeds and straw are made use of, *fig.* 30 shows a common arrangement. When the drain itself is filled with these materials, there should be a space above of at least one foot, which is to be filled with the surface soil; this should be heaped over the drain, that as the ground gradually consolidates it may not sink below the general surface.

In England, where draining is extensively practised, the plough is made use of in opening the drains, which materially lessens the cost of excavation. The following tools are also made use of in England: The drain shovel (*pl.* 30, *figs.* 10, 11, and 12), and drain hoes of various forms and sizes (*figs.* 8 and 9). The earth-borer is often made use of to advantage to ascertain the nature of the ground beneath the surface, as the labor of draining may often be reduced by finding a stratum of gravel beneath, into which the surface water may be conducted. For minor depths, the auger shown in *fig.* 15 is quite sufficient. When a greater depth of auger is required, an instrument, shown in *fig.* 16, is made use of. *Fig.* 17 is the shaft of the auger; *fig.* 18, the handle; *fig.* 19, the guide for directing the rod of the auger when a considerable depth is to be attained.

Whilst we are speaking of English operations, we will take occasion to mention a few instruments in use in England for cultivating and hoeing vegetable crops. *Pl.* 30, *fig.* 14, is a hoe used to thin out plants where they stand too thick; *fig.* 13 is a double-pointed hoe, of Portuguese origin, and serves to cultivate on both sides of a plant. The treble-pointed hoe (*fig.* 22) is for working between the rows of garden vegetables; *figs.* 23 and 21 are other forms of hoe used for the same purpose; *pl.* 30, *fig.* 20, is an instrument for cutting and grubbing up roots of trees and small shrubs.

F. Double Crops.

Not unconnected with the present article is the subject of double crops. We shall limit ourselves, however, to the consideration of a method practised with success in Austria, for obtaining a crop of small grain and a crop of roots from the same ground each year.

The field (*pl.* 30, *fig.* 1) is ploughed and harrowed in the usual manner, and planted with small grain, wheat, rye, or oats, in rows two feet apart;

before the grain is up the field is rolled and harrowed, which leaves it in the state seen in *fig.* 2. Upon the appearance of the grain (*fig.* 3), the cultivator or some other instrument is made use of between the rows. At the moment the first crop begins to show its ears, the second crop, which may be potatoes, turnips, or beets, is planted between the rows (*fig.* 4). *Fig.* 5 shows the grain ready for the harvest, and in *figs.* 6 and 7 the second crop has possession of the ground.

G. Flax.

This useful plant is harvested when ripe by pulling up the roots, tied in bundles, and dried in the field. It is then freed from seed by passing the heads through an iron comb, bound in small bundles and *rotted*, that the woody portion of the plant may be separated from the *harl* or fibrous portion. After the rotting is completed, it is dried and broken upon a simple machine called a *flax brake* (*pl.* 30, *fig.* 44). In the lower or stationary part of the frame there are three slats on edge, between which work two similar slats upon the movable frame which vibrates upon a pivot in the frame of the machine. The flax is laid upon the lower slats, and is broken by the motion of the upper frame, which is worked by the hand of the operator.

A great variety of machines have been invented for braking flax, which have in a measure replaced the hand machines. After the flax is broken, it is submitted to an operation called swingling, to remove the woody portions which have been broken up by the brake; it is laid upon a bench and beaten by the swingle (*pl.* 30, *fig.* 45 *c*), then it is *heckled* upon the coarse heckle (*fig.* 45), and lastly upon the fine heckle.

Pl. 29, *fig.* 42, is a machine for cleaning flax after it comes from the brake, which makes better work than the above manual operations. It acts in the following manner: two reels, *a* and *b*, revolve rapidly, nearly in contact with each other; the flax is attached to rods and hung at the frame at *c*, and is gradually lowered and raised between the revolving reels until entirely freed from the *hurds*, when it is fit to be spun.

H. Cider.

An important branch in the economy of the farm is the making of cider, which may be prepared from apples, pears, or plums. The ripe fruit is ground or mashed in a mill (*pl.* 30, *fig.* 47) driven by horse power, or upon a small scale in an apparatus represented in *fig.* 48, in which the fruit is crushed by a conical roller, pivoted in the centre of the table. Upon a larger scale, the fruit, after being ground in the mill (*pl.* 30, *fig.* 47), is carried to the press (*fig.* 49), the screw of which is worked by the rope *e*, or otherwise. The cider is received from the press in barrels, which are kept entirely full until the fermentation is ended. Its flavor is improved by the addition of strawberries, raspberries, or other small fruits, before the fermentation; lime or chalk is sometimes added, to check the too rapid fermentation. By the evaporation of sweet cider a syrup or molasses is obtained, by many preferred to that made from sugar-cane.

2. Live Stock.

A proper choice of stock is a matter of much importance. Whether the most improved or the common breeds are to be selected, depends upon climate, soil, and other circumstances. Good, sufficient food, shelter from the severity of the weather, and faithful attendants, are indispensably necessary to the thriving of all farm stock.

A. *The Horse.*

We shall here treat of the horse as a farming animal, and refer to the article Zoology, in the second volume of this work, for a scientific description of him, which would be out of place here. *Pl.* 31, *fig.* 19, represents the skeleton of the horse with the outline of his form; *fig.* 18, the appearance of the same immediately beneath the skin; *fig.* 21, a side view of the bones of the head; *fig.* 20, a top view of the same; *fig.* 30, a healthy knee-joint of the hind leg; *fig.* 31, the ligaments and blood-vessels of the same; *fig.* 32, the healthy bone, and *fig.* 33, a spavined bone of the same joint; *fig.* 34, the hoof of a five-year-old mare not yet shod; *fig.* 35, the same after having been shod a year; *fig.* 36, a section of the fore hoof, and *fig.* 37, a section of the hind hoof.

As the age of a horse is determined by the condition and appearance of the teeth, it becomes necessary to observe these closely.

They are divided into *incisors*, *tushes*, and *grinders*. In the full-grown horse there are twelve incisors, six in each jaw; the two front incisors, *aa* (*fig.* 24^a), are popularly called *nippers* or gatherers; the two next adjoining, *bb* (*fig.* 24^a), separators, or middle teeth; and the outer, the corners, or corner teeth, *e* (*fig.* 27^a). The tushes are between the incisors and grinders, *dd* (*fig.* 25^a). The horse has also twenty-four grinders, twelve in each jaw. There is, besides these, another or temporary set of teeth, called *milk teeth;* some of these are apparent at birth, others are developed in the first years afterwards. The horse is foaled with six *molar* or grinding teeth in each jaw; the twelfth day after the two front nippers appear above and below, and in fifteen days the two intermediate; the corner ones are not cut till three months after. At ten months the incisors are on a level with each other, and have a very sensible cavity; at twelve months this cavity becomes smaller (*pl.* 31, *fig.* 22), and the animal shows four molar teeth on each side above and below, three of the temporary or colt's, and one horse tooth; at eighteen months the cavity in the nippers is filled up, and there are five grinders, two of the horse and three of the colt's; at two years (*fig.* 23) the first of the colt's molar teeth in each jaw are displaced, and the cavities in the corner teeth are not yet quite filled up; at two years and a half or three years, the front nippers fall and give place to the permanent ones; at three and a half the middle nippers are likewise removed, at which period the second milk molar also falls (*pl.* 31, *fig.* 24^a), and the four corner teeth continue to protrude themselves more and more (*fig.* 24^b).

At four the horse has six molar teeth, five of his new set and one of his last; the corner colt's tooth, seen from the side, has become very small (*fig.* 25[b]); at four and a half years these corners are replaced by the permanent teeth, and the last temporary grinder disappears. At five years the principal indications are found on the corner teeth and tushes; the corner teeth have their inner and outer edges upon a level, and the tushes are developed (*figs.* 26[a] and 28[b]); at five and a half they are completely out, and the internal wall of the upper nippers, which was before but incompletely formed, is now on a level with the rest; at this period the nippers or incisors have all of them a cavity formed in the substance between the inner and outer walls, and it is the disappearance of this that marks the age; at six years those in the front nippers below are filled up, while the cavities in the corner teeth are still deep, the tushes well grown, and their points more or less worn off (*figs.* 27[a] and 27[b]). At seven years the mark or cavity in the nippers is filled up, and the tushes are a little more worn (*figs.* 28[a] and 28[b]). It often occurs, however, that there is a depression in the cavity of the nippers, and also, in the middle teeth, no real cavity, but a slight brown depression. At eight years the cavities have entirely disappeared, and the tushes are still more worn (*figs.* 29[a] and 29[b]); at this period the horse is said to be *aged* and to have lost his mark, but among good judges the teeth still present sufficient indications. At nine years old the groove in the tushes is nearly worn away, and the nippers become rather rounded; at ten these appearances are still stronger; at twelve the tushes only exhibit a rounded stump, the nippers push forward, become yellow, and as age advances appear triangular and usually uneven. There are also other indications of great age in the horse, such as rough, uneven hoofs. *Pl.* 31, *figs.* 38*to 47, show the foot of the horse in several diseased forms; spavin, windgall, malanders, ring-bone, club-foot, &c.

B. Neat Cattle.

The raising of neat cattle is an important branch of husbandry, even considered independently of the usefulness of the ox as a beast of burden. The flesh and the milk, either in its natural state or in the form of butter and cheese, serve as food, the hide and other portions of the animal as articles of commerce. From the wild ox of Europe have descended many varieties, much modified by taming or cultivation. We shall figure a few of the most noted of these varieties: *pl.* 31, *fig.* 2, is a Swabian cow; *fig.* 4, a Sussex bull; *fig.* 5, a Sussex cow; *fig.* 6, a Herefordshire cow; *fig.* 7, a Devonshire ox, and *fig.* 8, a Kiloe ox; *fig.* 1 is a Swiss cow of the mountain race; *fig.* 3 is a Swiss bull. This latter race is of medium size, not remarkable for its fattening qualities, but superior milkers.

The ox is very generally used as a beast of burden. When an animal is stubborn and refuses to pull, he should be yoked to a heavy weight, as seen in *pl.* 32, *fig.* 1, in such a position that in order to reach the food trough he must haul up the weight, and thus he becomes gradually accustomed to the strain upon his shoulders. The question of the relative profit of the horse

and the ox as beasts of draught is still undecided, and must be determined for each locality by existing circumstances, climate, &c. The horse is much more subject to disease than the ox, while the latter is more easily fatigued, particularly in warm latitudes. Amongst the diseases to which horned cattle are subject is that very dangerous one caused by eating too greedily of green food; this produces such a quantity of gas as to endanger the life of the animal, which oftentimes is only saved by opening a vent for the gas from the stomach. *Pl.* 32, *fig.* 3, is the knife used for this purpose, and at *fig.* 2 is seen the manner in which it is applied. The knife is plunged into the animal with its sheath, which is left in the opening when the knife is withdrawn, to prevent the immediate closing of the wound.

Particular cleanliness is requisite in the management of neat cattle, also light, well-aired stalls, such as are represented in *pl.* 32, *fig.* 4. *Pl.* 29, *fig.* 44, is a plan and elevation of a cattle-barn. The cattle-stalls are in the centre of the building, with a passage-way between the cribs and the wall for the purpose of feeding without disturbing the animal. The building should be furnished with a chimney, with a valve for purposes of ventilation.

The milk as it comes from the cows is strained immediately into cans (*pl.* 32, *fig.* 4), and is then set away in shallow pans in the dairy room. In large establishments an especial house is devoted to the milk, butter, and cheese (*pl.* 30, *fig.* 42). *Fig.* 43 is the plan of such a house. *a* is the milk-room, with shelves around the walls for the milk-pans, and a table in the centre. This portion of the building has very thick stone walls, and only one window, *d e*, which runs slanting through the wall, and is glazed on both interior and exterior. There is also a ventilating chimney to keep the room well aired. In the room *b* the butter and cheese are made and the utensils kept; *f* is a fire-place used in making cheese. In the room *c* the butter and cheese are preserved; the centre of the room may be partitioned off for an ice-house, which can be filled through the passage *g h*, and the exterior space, *i k l m*, remains for the butter and cheese. In this room is kept the *lactometer*, which should be found upon every milk farm; it is seen in *pl.* 32, *fig.* 5, and consists of a row of cylindrical glasses of equal size and similarly graduated. The best milk is first poured into the glasses, and when the cream has separated from the milk, its thickness or quantity is noted on the graduation; this serves then as a scale with which to compare the milk of the other cows.

By butter-making is understood the process of separating the oleaginous portions of the milk by means of a rapid and violent shaking; this is ordinarily accomplished in the churn represented in *pl.* 32, *fig.* 6^a. *Fig.* 6^b is the dasher. A more convenient churn for large establishments is represented upon the same plate; *fig.* 7 is a barrel-shaped vessel resting in the frame (*fig.* 9). The dasher (*fig.* 8) is hung upon an axis within the barrel, and is worked by a crank. *Pl.* 30, *fig.* 46, represents an English churn, in which the dasher, at the same time that it is raised and lowered, is rapidly revolved, by which arrangement the cream is much more violently agitated. After the butter has separated from the buttermilk, it is worked and beaten

by the hand or by wooden implements until all the buttermilk is worked out; it is then salted, and if intended for transportation or keeping, is packed into firkins or jars, to preserve it as much as possible from contact with the atmosphere.

Cheese is also another product of milk; the solid portion of the milk or curd is caused to separate from the whey or watery portion, by the addition of rennet, which is the stomach of the calf dried and preserved for that purpose. The curd is first drained in a bag, then salted, pressed, and set away in the cheese-room to dry. *Pl.* 32, *fig.* 10, is a common form of cheese-press.

C. The Sheep.

So easily does the sheep accommodate itself to differences of climate and situation, that every country has its peculiar race. In *pl.* 31 are represented some of the most important varieties. *Fig.* 9 is an improved Merino ram, *fig.* 10 a ewe of the same; this breed has fine short wool, particularly adapted to fine cloths. The Saxon Merino or Electoral race is a cross between the Saxon sheep and Spanish Merino; it produces light fleeces, but of the finest, softest wool. The English breeds have run into great variety by crossing, some furnishing long, others short wool; of the latter are the Southdown sheep (*fig.* 11). *Fig.* 12 shows the Leicester breed, *fig.* 13 the Herefordshire. In most countries the sheep are driven in at night and confined in stalls. Sometimes they are permitted to remain all night in the open air, but in this case they are confined in a movable inclosure or hurdle *pl.* 32, *fig.* 12); or as the night air is considered to injure sheep in the climate of England, movable sheep stalls are sometimes made use of (*figs.* 11^a and 11^b). At other times stationary shelters are erected for them, into which they are driven every night. *Pl.* 32, *fig.* 13, is such a sheep-fold or stall, so arranged as to serve the purpose of sheltering the sheep at night, while it is furnished with shelves on which silkworms are fed.

D. The Hog.

Next in importance to the sheep comes the domestic hog. In form it varies but little from the wild hog of Europe, from which it is descended. Its teeth are rather remarkable; they are 44 in number, twenty-eight back teeth, and above and below six front and two corner teeth. By cultivation it has run into numerous varieties, a few of the most important of which are figured in *pl.* 31. *Fig.* 16 is a boar, *fig.* 17 a sow of the Berkshire breed; *figs.* 14 and 15 are of the Chinese race, which have been more or less introduced into England and on the continent of Europe. Everything which can be digested is devoured by this voracious animal. Roots, fruit, grain, or carrion, nothing comes amiss; its own young are not safe, even when other food is plenty, but the character of the flesh depends upon the nature of its food. Where this is flesh or oily nuts, the flesh is very inferior; but where fed entirely upon milk and grain, the meat is extremely delicate. Where potatoes are used for feeding hogs, they are first washed in a machine (*pl.* 29, *fig.* 43) and cooked, which process is found to add greatly to their nutri-

tious qualities. The above machine consists of a cylinder revolving in a frame; the cylinder is partially filled with potatoes and revolved until the friction has loosened the dirt from them; it is then filled with water, or a stream is kept running through it, until it flows clean from the machine.

E. The Silkworm.

Silk is an animal production, spun by the so-called *silkworm*, the larva of the *Phalæna bombyx mori.* The animal is furnished with a collection of vessels in which is secreted, about the time of spinning, a glutinous liquid which hardens on exposure to the atmosphere, and forms the silk thread, which is usually about two thousand feet long, and is strengthened for use by doubling. In the raising of the silkworm the first care should be to provide the food; many substitutes have been tried for the mulberry, but nothing has yet been found to take its place.

The white mulberry, the leaves of which furnish the best food for the silkworm, is indigenous in Syria, Persia, China, and southern Germany. That the leaves may be gathered with ease, the tree should not be permitted to grow very tall, but be shortened in every season, for several years after it leaves the nursery. *Pl.* 32, *fig.* 31, may be cut in, as seen in *fig.* 30; the following year the branches which it has pushed (*fig.* 33) are headed down, as seen in *fig.* 32, and so on each succeeding year, as seen in *figs.* 34, 35, 36, and 37, until the tree receives a low bushy form, from which the leaves may be easily gathered. Recently the mulberry has been grown in hedges, from which the leaves may be gathered without trouble. The *Morus multicaulis* is best adapted to this mode of culture. The rooms in which the worms are fed are furnished with shelves one above the other; or more properly removable frames made of plaited willow roots or coarse netting (*pl.* 32, *figs.* 16 and 17); they should be well ventilated, and capable of being darkened when required. There should also be arrangements for heating the apartments, that an equable temperature may be maintained, and the air kept constantly dry; should the air become too dry it may be corrected by placing vessels of water in the rooms.

The first care of the silk-grower is to procure good eggs; cocoons are selected of a white or yellow color; the female cocoons (*pl.* 32, *fig.* 24) are rounder in the middle than the male (*fig.* 25), which have a deeper depression in the centre. Equal quantities of both are selected. The cocoons inclose the *pupa; fig.* 26 is the female, *fig.* 27 the male. A temperature of 50° to 80° Fahrenheit is necessary to bring them out, and a period of two to three weeks is required; this should take place in a tolerably dark room.

Figs. 28 and 29 are the perfect insect, the former the female, the latter the male. Soon after hatching they are permitted to come together. After a few days the male dies, and the female, after laying five to six hundred eggs, dies also. These eggs are permitted to hatch at a time when the young leaves of the mulberry are tender. The eggs (*fig.* 18) are placed in boxes (*fig.* 15), which in eight or ten days are placed in frames covered

with paper, and pierced with holes, upon which some young mulberry leaves are strewed; from the tenth to the fourteenth day the eggs hatch, when they are carefully carried to the feeding apartments. Several distinct periods are distinguished in the life of the silkworm; during the first (*pl.* 32, *fig.* 19) the worm is sparingly fed with cut leaves. In the second period (*fig.* 20) the supply of cut leaves is increased; during this period the first skin is cast. In order to clean the frames, tender branches of mulberry are laid over the worms, and when they have crept upon them they are removed to a clean frame. On the fourth day of this period the second skin is cast. In the third period (*fig.* 21) the worms are again removed, and on the fifth day the third skin is cast. On the sixth day of the fourth period (*fig.* 22) the fourth skin is cast, and the frames are again cleaned. In the fifth period (*figs.* 23^a and 23^b), the feeding increases until the tenth day, when it again decreases gradually. On the 11th day the worms cease eating, the body becomes transparent, and the thread is visible. The spinning-chamber is now arranged with branches of birch, upon which the worms creep and wind their cocoons (*pl.* 32, *fig.* 14). This operation occupies six or seven days, though the cocoons should not be removed until the tenth day.

The chrysalis is then to be killed, which is effected by exposing the cocoons to a high heat, to steam, or the vapor of turpentine. They are then thrown into hot water to loosen the glue which binds the threads together, and the silk thus loosened is wound upon a reel eight to twenty-four threads together. Nine or ten pounds of cocoons give 1 pound of silk.

F. The Honey Bee.

The rearing of bees, though not generally pursued by agriculturists, is one of the most interesting employments of the husbandman, while there is none in which he can engage which affords so large a profit upon the capital invested, or the labor and attention required.

In a wild state, bees occupy hollows in trees, living in families of from 20,000 to 40,000. In a tame or cultivated state, however, they are kept in boxes or baskets made of straw or willow roots, called hives. A complete swarm of bees consists of one queen, the mother of all the other bees (*pl.* 32, *fig.* 43), differing in form and shape from them all; her wings are much shorter, and her legs are without the brushes and cavities with which the working bees are furnished. The queen is the object of the attention and solicitude of the whole hive, and alone lays the eggs which produce the working bees; the latter (*fig.* 45), which are the smallest and most numerous in the hive, are produced in small cells, and are but sparingly fed at first. When fed with the food prepared for the queen they lay eggs, which, however, produce only drones (*fig.* 44). The working bees have stings, and upon their legs brushes, with which they collect the pollen which adheres to the hair of their bodies from the flowers, and pack it away in small cavities or baskets on their legs; this pollen is thought by most naturalists who have turned their attention to the subject, to be made use of by the bees only for the purpose of feeding their young, their own food being exclusively honey, or sugar in some other form. The drones

are the males; like the queen, they have neither brushes nor cavities on their legs.

The impregnation of the queen is effected by the drones on the wing and without the hive. *Pl.* 32, *fig.* 55, is a sheet of honey-comb; *a* is a closed drone cell; on the left is seen a queen's cell, and on the right another half completed. Within their hive the bees close all openings and cracks with a substance called *propolis*, which they gather from resinous or other trees in the state in which it is used, and then commence the building of the combs. The cells destined for the queens are many times larger than the others, and require 100 to 150 times as much wax. There are also about 1200 to 2000 drone cells and smaller cells in which the working bees are hatched. Besides these there are others less regularly formed, and used only for storing honey.

The queen lays during the summer from 16,000 to 18,000 eggs, the care of which devolves upon the working bees, assisted, it is believed by some, by the drones. The larvæ produced from these eggs are fed with honey mixed with the pollen of flowers, called bee-bread; in seven to eight days the first transformation takes place; the pupa is then shut up in its cell, and after thirteen or fourteen days the perfect animal comes out, and an hour or two afterwards is ready to start out on its labors. Those which are crippled or disabled are immediately killed and carried out of the hive. When two queens exist in the same hive, one of them leaves with a portion of the family, and the bees are said to *swarm; pl.* 32, *fig.* 42, shows a swarm of bees, hanging one to the other upon a branch of a tree.

When the bees have completed their labors and the hive is filled, they are smothered with sulphur, and their store of honey and wax is taken. Many hives have been contrived by which the surplus honey is taken without destroying the bees, and the lives of these interesting insects are spared. *Pl.* 32, *fig.* 56, is a hive contrived by Thorley for this purpose; the lower box is the habitation of the bees, and has a hole in the top over which a straw hive or other box is placed; when the lower box is filled, the bees ascend and fill also the one above it, and at the close of the season the upper box may be taken from them, leaving sufficient provision for the winter in the lower one. On top is seen a glass globe in which the bees may be watched at their labors; it is, however, necessary to keep the globe covered with another box to exclude the light. *Pl.* 32, *fig.* 57, represents the collateral hive of White, consisting of wooden boxes placed side by side, with openings for communication in each box; they are represented in the figure as separated from each other, to show the openings; when the labors of the bees are over for the season, one of these boxes with its contents may be removed, leaving them the other for their winter support. The most common material of which hives are constructed in Europe is straw; the form most usual is seen in *pl.* 32, *fig.* 38; in the United States wood is almost exclusively made use of. *Fig.* 52 is a style of straw hive much used in England; several of these are placed one above the other, and the top one is furnished with a cover. One or more of these boxes is taken from the bees in the fall, leaving, as usual, sufficient honey to carry them through the winter

Besides the straw cover which surmounts the whole, each hive is furnished with a wooden cover composed of slats (*figs.* 52 and 53); these bars should be $1\frac{1}{8}$ inches wide and placed at a distance of half an inch from each other, and are for the purpose of supporting the combs attached to them. Other hives have been used with glass windows (*figs.* 48–50), through which the operations of the bees may be watched; *fig.* 54 is the cover of the hive seen in *fig.* 50, showing the openings through which the bees pass to the glasses above. The better to observe the bees at their labors, the bottom or sides of the hives may be made of glass (*fig.* 51); *figs.* 40 and 41 represent a barrel hive, much used in Europe, where the bees are managed on the depriving system; at the close of the season the hive is opened and the surplus honey is cut out; to facilitate this operation, the division boards, which in *figs.* 47 *a* and *b* are horizontal, are in this hive placed vertically.

Bee-stands are the shelters in which a number of hives are placed, and may be either large wooden boxes, containing a number of hives (*fig.* 46), or masonry structures (*fig.* 38), or detached sheds, open upon one side or entirely closed (*fig.* 39), the object in every case being to protect the hives and bees from the sun, rain, and cold winds.

X. HUNTING AND FISHING.

1. Hunting.

Hunting is the art of chasing and capturing the various kinds of wild animals, either with a view to their destruction as vermin, or as affording sport in the pursuit, or as furnishing food, clothing, or other economical results. The classification sometimes adopted in professional treatises of different degrees of the art, varying with the kind of game, will here be unnecessary.

Hunting in Europe differs very materially from the art as practised in America, if indeed it deserves the name of an art upon the latter continent. There the noxious animals have become scarce, comparatively speaking, and *game* properly so-called is in most places protected by law, and killed only by the privileged classes. In many parts of America, on the contrary, bears, wolves, jaguars, &c., are still to be found in abundance, and game may be taken by any one who has the inclination to seek and possesses skill in finding and capturing. Whilst in Europe hunting has become an art usually practised by the rich and noble or their retainers only, in America the field is open to all, and in most cases hunting is practised in a very unskilful manner. In presenting the following article, therefore, our object is not so much to afford instruction to our American readers, who will probably derive from it little or no information of practical importance, as to show the manner in which hunting is carried on in the civilized parts of the Old World, to give an account of the implements used, the different species of animals pursued, &c.

The animals sought after in Europe are Bears, Deer, Roes, Wild Boars, Hares, Foxes, Badgers, Beavers, Otters, Martens, and Wild Cats, among quadrupeds, and Wood Grouse, Moor Fowl or Red Grouse, Pheasants, Partridges, Woodcock, Snipe, Quail, Swans, Wild Geese, Wild Ducks, Buzzards, Curlews, Plover, Corncrakes, Fieldfares, &c., among birds, and the order in which they are mentioned will indicate their relative importance in the eyes of the hunters and sportsmen of that country.

A. Aids in Hunting.

Success in hunting depends in a great measure upon the sagacity and training of the dogs employed to discover the trail of game and other animals. Hence it is necessary that the hunter be provided with good dogs, the training of which should, whenever possible, be superintended by himself. At the head of hunting-dogs stands the slow-hound, by means of which the trails of wild animals are discovered and followed up. The education of this kind of dog is a task requiring great care, and three years are usually consumed in the process. If the animal is not perfectly trained at the end of this period of time, the blame should rest upon the trainer, provided the dog is of a good stock. The slow-hound may be trained upon stags and wild boars. For baiting-dogs, the Bull-dog, Danish Mongrel, Wolf-dog, and Pomeranian Boar-hound are employed; they also require a very careful education, and should be taught not only to catch a wild animal when wounded, but to seize it at the proper place, and not to make the attack from behind. In addition to those already mentioned we may also name the Boar-finder, the Pointer, Setter, and Spaniel, the Greyhound, used in catching hares, the Badger-dog, employed in searching for foxes and badgers in their subterranean retreats, the Otter-dog, and even the Poodle, which may be trained as a water-dog. Horses are also of assistance in hunting, and are used either as stalking-horses, behind which the hunter conceals himself in order to approach within proper distance of game, or as saddle-horses mounted, upon which the hunter follows deer, &c. In this connexion we mention, finally, Hawks, although falconry at the present day has been almost entirely abandoned. For this description of hunting all the species of hawks are employed, but a careful education is required to render them serviceable. Immediately after the capture of a hawk its talons are cut off, and a cap of strong leather (*pl.* 33, *fig.* 48), made in such a manner as to cover the eyes completely, without, however, causing a painful pressure upon those organs, is clapped upon the head, and removed only at bathing and feeding times. The wings are confined by means of the collar (*fig.* 50 *b*, *c*), a strap of fourteen inches in length, provided with a slit, whilst the feet are shackled with the catching shoes, rings nearly four inches long with loops supporting the bill. To the catching-shoes are attached leather straps used for keeping the hawk at a greater or less distance. Hawks are kept in a mews or house arranged for the purpose, on hoops or horizontal poles, are attended to very carefully, and now and then bathed; the Jer Falcon requiring to be frequently sprinkled with cold water. The training of hawks is a work troublesome in the highest degree.

They often fly away, even those that are best trained. When this occurs the falconer throws up a lure (*pl.* 33, *fig.* 49), which is an imitation of a bird, or merely two wings fastened together, or even a live pigeon is made use of in order to bring back the wanderer to the proper course. Herons, cranes, buzzards, crows, pies, hares, ducks, partridges, and quails, may be hunted with hawks. Falconry has never been practised to any great extent in North America, though some American falcons, the duck hawk and pigeon hawk (*Falco peregrinus* and *columbarius*), might be usefully employed.

B. Practical Hunting.

In order to convert a heath or forest into convenient *hunting ground* it is divided into exact squares by means of alleys intersecting 900 paces from each other, the distance ascertained to be the best. On each quadrangle six toils of cloth or some other stuff are needed, being part of the apparatus of hunting practised in artistic style. On *pl.* 33, *figs.* 1 and 2, are exhibited *toils* of the ordinary description, which should be ten feet in height each, and 150 paces in length, calculating three feet to a pace. Two breadths of linen usually reach to a height of nine feet, to the upper edge of which a network one foot high is attached, the meshes of which are made of strong twine or packthread. A strong cord is sewed to the top and bottom of the cloth, and furnished with short sticks and rings. When network is not used, a very broad cord, or rather binding, is attached. *Fig.* 3 exhibits a rolling or drawing toil, which is almost indispensable in many cases, as, for instance, in hunting wild boars. A toil of this description is disposed (as shown in the figure) across the place through which it is supposed the game will pass, in case any should be driven out of the woods. When the animal has passed through, the toil is stretched out. Several poles belong to a drawing toil.

Nets of different descriptions have been in use for a longer period of time than toils. Nets for stags are much stronger than those employed in the capture of smaller game. *Fig.* 6 exhibits a deer-net of this description. Tossing nets (*fig.* 5) are called also mirror nets because the threads cross each other at right angles. The meshes are six or seven inches square. Boar-nets are only half as high as stag-nets, and those used for taking roes are likewise somewhat lower, the rope being of the thickness of a quill, and the width of the meshes four inches. Wolf and hare nets are also used; the latter, however, are lower, with meshes of three inches square. *Rows of patches* are also employed for the same purposes. The patches (*fig.* 4) are about three quarters of a yard square, and, that they may blind more readily in the dark and in the forests, which is the only end in view, consist of bleached linen or cotton cloth. In cases where the apparatus employed in the more artistic kind of hunting is not sufficient, the patches come into use; and when they are not placed too near, and the game is not too tightly entangled, the animal prefers receiving the shot to passing through the patches. Besides the cloth rags, *bunches of feathers* (*fig.* 7) are very useful. The latter are composed of feathers of birds of prey, amongst which those

of geese may be mixed. In making this apparatus, two feathers (*fig.* 6) are fastened together by the quills, which are split for that purpose. They are then passed along the rope by means of loops. The bunches are always ten inches apart, and the row when finished is placed upon the reel, where they are spread and stretched. Another mode of making the bunches is shown at *fig.* 9, *a* and *b*, in which the feathers are soaked, so as to enable the manufacturer to tie them into knots in threes, two on one side and one on the other. They are then looped up on the rope, and firmly stretched by means of gags. They are likewise placed at distances of ten inches from each other and reeled up.

Besides the foregoing our plate exhibits other implements which complete the hunting apparatus. *Fig.* 10 represents a pole of beech-wood, with a branch at top, *a*, and a similar pole furnished with iron hooks at the upper end, *b*. *Fig.* 11 is a pole of fir or pine, very light, having at top a hole or notch, through which the cord passes. A pole for a high toil must be ten feet long. *Figs.* 12 and 13 represent two net sticks, the upper extremity of the one at *fig.* 12 having a straight branch to it, while the one at *fig.* 13 is merely notched. The former are more conveniently arranged, as the cord might easily escape from the notches of the latter. The accompanying propping poles (*fig.* 14) are three feet long, and furnished at the two ends with iron hooks or rings. *Fig.* 15 is a straight fork for elevated apparatus. It is six feet high, and provided at top with a fork, one of the prongs being somewhat shorter and slightly bent, the other a little longer and bent outwardly. *Fig.* 16 is another rod, indispensable where riding is necessary. These rods are stouter than the poles referred to above, are eleven feet three inches in length, and furnished at top with a hole, through which passes a handle or very strong ropes reaching on both sides down to the hooks or pins, to which they can be fastened. At top is an iron ring with a hook to it to receive the upper ropes of the cloth and one of the winding ropes. For raising and lowering the toils a brass bar is added above, through which passes a cord three fathoms in length, and furnished at one end with a piece of wood. *Figs.* 17 and 18 represent hooks, on which roe and hare nets are stretched and fastened; they are four feet long and pointed below. A complete hunting apparatus, moreover, must include a paling and punching iron (*fig.* 19) for making holes for the poles, *a*, and another instrument, *b*, used in setting up the nets and patches, which consist of a rounded piece of wood tipped with iron. Pins (*fig.* 20) of oak, beech, or any hard wood, should always be at hand, as also small hooks with which to fasten the toils to the ground; also a mallet (*pl.* 33, *fig.* 21) for driving down hooks and pins. *Fig.* 52 is the needle used in making the net. *Fig.* 53 represents the pack starting for the hunt, and *fig.* 54 the chase of the wild boar.

C. Shooting, Trapping, &c.

Under this heading we include the methods of hunting in which neither toils, nets, patches, nor feathers are employed. Hence we shall consider

1. Shooting. The best way for a hunter to approach his game is to move

against the wind. Wild animals, birds especially, possess so delicate a sense of hearing as to render it a difficult matter to come within shooting distance by going in the direction of the breeze. When the haunt of game has been discovered, the sportsman stations himself in the vicinity, and to the leeward, early in the morning or in the evening, and waits until the animal sought for appears. But if unsuccessful in this way, the ground must be explored to the leeward and search made. Wild boars are hunted with good boar-hounds also to the leeward, and when the animal appears, may either be shot in front of the dogs or killed with the hunting-knife, whilst the hounds hold it fast. Roes are brought within shooting distance by imitating the cry of the doe to her young, by means of a leaf or a piece of birch bark. The roe soon approaches and is slain.

2. Catching the Badger. When the winter retreat of the badger, or the passage through which it goes in and out during the summer season, is discovered, a piece of heavy wood is placed before the entrance, and fixed in such a manner in connexion with another piece, that upon the animal's entering or leaving it must necessarily fall down and crush the badger by its weight. Another mode of capturing the badger is by means of the hood, which is a network of packthread furnished with iron rings. The hunter, having placed the hood at the entrance of the retreat, watches until the badger leaves it, and after the animal has got his head into the apparatus, it is closed around his neck. When the hood has been placed in the proper position, it is necessary that the badger should be driven from his hole by dogs. The badger may also be taken by means of the iron apparatus exhibited at *fig.* 25. Plates of good iron are used, which are placed before the entrance of the retreat, and covered slightly with earth. The plate, however, should be rubbed with the acicular leaves of the fir tree, or foliage of the oak or beech, and even then the badger ventures to run over the plate only when all other passages are closed. The plate should be well fastened to the spot or the animal may take it with him into the hole, in which case it would become necessary to dig him out. Another implement is exhibited at *fig.* 24. In order to protect the hunter from the blows of the badger, the animal is seized by means of the nippers (*fig.* 33).

3. Taking the Fox. In the first place, foxes may be shot whilst running. They are also caught in holes dug for the purpose, or taken in their dens by means of badger dogs, and finally, may be driven into nets placed at the entrance of their retreats. The best mode of catching the fox is by iron traps (*figs.* 22 and 23). Foxes may also be caught by means of the iron plate (*fig.* 25). A wooden trap (*fig.* 40) is used for the same purpose. Two pieces (*a* and *d*), each four feet in length, are placed on the ground, and at one third that distance apart. Both are fixed firmly, and slightly covered with earth. An upper piece (*c*) is five feet and a half long, and sustained by small poles. A transverse rest (*d*) is placed near the summit of two solid supports, and each movable piece of the apparatus rests upon appropriate sticks. At the other end, the upper pole slopes in such a manner as to form a slightly-opened hinge, and is attached to a stretched string

(*h*) extending the whole length of the trap. This apparatus is made at leisure, and allowed to stand out during winter and summer, without apparent design, so that the foxes may become familiar with its appearance. As soon as the fur of this animal becomes good again, the trap is put up and baited, when the fox happens to be in its retreat during rainy or bad weather. In attempting to go out he is caught under the trap and crushed. It must be understood that a trap of this description should be placed at the entrance of each fox-hole. In taking foxes with iron hooks, either the kind exhibited at *fig.* 27, called the German hook, or the Lorraine hook (*fig.* 26), or the French hook (*fig.* 28), may be used. These figures are so beautifully and minutely drawn, that it is unnecessary to describe the instruments particularly.

4. The Otter. The otter is taken either in the water or upon land, by means of the iron plate, on which the bait is to be fixed. Or the snare (*fig.* 29) may be used, constructed much like *figs.* 22 and 23, the only difference being this, that instead of beams, barbed blades are employed. The otter-trap is represented at *fig.* 37. The clod-trap (*fig.* 38) is used for the same purpose.

5. The Wild Cat and Marten. The wild cat is caught by means of the iron plate baited in the same way as for the fox, or may be shot whilst running. Martens are fond of frequenting the same places as foxes, and are taken in the same kinds of iron traps; the wooden trap may also be employed. For tree martens the wooden trap (*fig.* 39) is in general use, being fixed at a height of from three to four feet. The bottom pieces are firmly fixed on two forked poles or on two branching young trees. Martens are taken with nets also and with board traps. Of the latter we shall say a word when we speak of the polecat.

6. The Polecat. The polecat is generally caught in the same manner as the marten and also with polecat traps (*figs.* 35, 36), the latter being used also for taking the marten. Polecat traps are constructed of boards, and are so simple that a glance at the figures will show the method of making them. Before setting up the trap, the animal must be rendered familiar with the locality by depositing from time to time food relished by it. After this has been done a dead bird or raw egg is laid upon the tongue-piece of the trap, which must be set doubled in such a manner as to oblige the animal to pass through it in order to reach the bait. A plain trap should have a grating of iron wire at its posterior end. Polecats may be taken also in spring-traps (*figs.* 33, 34). Being constructed at a small expense, great numbers may be scattered about. A small bird is suspended between the loops, and when the animal attempts to take the bait, the loop is detached and incloses the game.

7. The Weasel. The weasel is most readily taken in the double board-traps exhibited in *pl.* 33, *fig.* 36, and which are laid for the most part in hen-houses and pheasant walks or preserves. Weasels will also go into the wire loops exhibited in *figs.* 33 and 34.

8. The Pheasant. In places where wild pheasants are to be found pheasant dogs are employed to search them out. When they come upon a

bird, it rises and alights upon a tree, and the dog runs round and round, barking at it, until the sportsman makes his appearance and shoots the game (*fig.* 55). Pheasants may be hunted without dogs on a bright starry night, or when the moon shines faintly. These birds are taken also in thorn nets or tunnel nets, and finally, with the *pheasant trap* (*fig.* 44), which consists of a large box resembling a house, on the outside of which one or several silk nets, or linen walls, fall down when the trigger or holding-piece of the apparatus is pulled in the attempt of the pheasant to take the bait.

9. Wild Geese and Ducks are caught in nets of different kinds, on land or water, or (especially the ducks) with fishing tackle. They are also procured by shooting. For this purpose a cabin of leaves is constructed upon the shore, towards which the ducks are attracted by means of the bird-call, or they are killed from a boat (*fig.* 56). In boat-shooting the gun is rested upon a support (*fig.* 51), and the skiff rowed cautiously from place to place. Ducks, however, being difficult to approach, it is better to make use of decoys, or even the shooting horse, behind which the sportsman hides himself until the birds come within distance.

10. Partridges were formerly taken in nets made of thorn bushes, but having now become scarce (in Germany) are reserved for shooting, or caught in the partridge-trap (*fig.* 43), constructed upon the same principles as the pheasant-trap described above.

11. Fieldfares and other Small Birds. In taking fieldfares and other small birds the apparatus most in use is the gin (*fig.* 30) or horse-hair loops, tripled or quadrupled according to the necessity of the case. The bait consists of berries. *Fig.* 30 represents the bow-gin. Snares somewhat similar to those used by boys in America for rabbits are also in use for catching snipes. *Figs.* 31 and 32 represent spring snares in which birds are strangled. Another mode of taking birds is by means of the trap exhibited in *fig.* 45. A very useful contrivance for catching singing birds in numbers is the fowling-floor (*fig.* 46). This is a mound, *a*, of 18 or 20 feet in length by 12 feet wide, and 3 feet in height, covered with sods on which little twigs with berries and trained decoy birds are placed. Other decoy birds are hung in cages in neighboring trees, BB. Around the mound is fixed in the ground a large net with small meshes, which is carefully folded down on the ground. Its upper edges are fastened to a double frame, *gg*, capable of being closed round the hinges, *ff*, and whose extremities are held firmly to the ground between stretched ropes passing crosswise from the spring-poles, *ee*, through rings at the end of the frame, to the pegs, *dd*, driven into the ground. Two lines, *hh*, are passed under the frame and over the blocks, *cc*, and are united into one line, *b*, which is governed from the hut, C, where the fowler is stationed, and which has only small loopholes on the side towards the mound, the door being on the opposite side. A pull at this line will lift the two sides of the frame a little from the ground, when the spring-power of the poles, *ee*, will immediately act, and rapidly draw the two halves of the frame into a vertical position over the fowling-floor, causing the net to be lifted and closed over the mound. This

contrivance is chiefly in use in Thuringia, a district in Germany, which annually exports many thousands of the finest singing birds.

12. BIRDS OF PREY. Birds of prey, besides being shot and destroyed in other ways, may be taken with the gin net, which also proves of service in catching other birds. *Figs.* 41 and 42 exhibit two kinds of traps, *fig.* 41 for partridges, *fig.* 42 for smaller birds. When intended for rapacious birds they are constructed on the plan of *fig.* 42, but much stouter.

2. FISHING.

A. Fresh Water Fishing.

1. FISHING WITH HOOK AND LINE. The general principles of bait-fishing are so well known that it is scarcely necessary to mention them here. The apparatus is exceedingly simple and within the reach of almost every one, but in many cases great skill is necessary to capture the so-called game fish.

The instrument usually employed for hand fishing is the rod and line (*pl.* 34, *fig.* 1) held in the hand, and the baited hook cast into the water. Sometimes a swimmer or float is attached to the line, to show more readily the attack of the fish, or to regulate the depth to which the bait ought to sink. The bait varies with the fish to be captured, with the season, and with the condition of the water. It may consist of a worm, caterpillar, grasshopper, bit of meat, small fish, frog, and indeed animal matter of almost any kind. Sometimes a number of short baited lines are attached to a longer one, which is then stretched out in the water, and allowed to remain over night.

2. FISHING WITH NETS AND WEIRS. This mode of fishing affords more abundant results than the preceding, but its machinery is much more complicated and expensive. The forms of nets are very various, differing with the species of fish, locality, &c. A simple kind is that known as the *scoop* or *hoop-net*, consisting of a netted bag attached to a hoop with a long handle (*pl.* 34, *fig.* 2). The *dip-net* is a square piece of netting, stretched by the corners between two semicircular hoops, which cross each other at right angles, and are suspended from a long pole. The *fish-weir* is represented in *figs.* 4 and 5, the *set-net* in *fig.* 6, the *seine* or *haul-net* in *fig.* 3. *Fig.* 7 shows the construction of what is usually called a *fish-pot* or *basket.* The *casting-net* is much used on the Southern sea-coast of the United States. This consists of a circular net with weights around the circumference, and a long rope attached to the centre. This is cast into the water, and the circumference sinking more rapidly than the centre, any fish which happen to be beneath are immediately inclosed.

3. FISHING BY FIRE. This consists in attaching an iron vessel containing burning splints to the bow of a boat, or carrying it by hand close to the water. The light attracts the fish, which are then taken either by hand or by means of scoop-nets, spears, gigs, &c. (*pl.* 34, *fig.* 8).

B. Marine Fishing.

It will already have been understood by our readers that fishing includes not only the capture of fishes, but of aquatic animals in general. Under this head, therefore, may be given the catching of whales, crabs, oysters, lobsters, &c., in addition to that of herring, cod, tunny, mackerel, &c. We have, however, presented the general features of the whale-fishing under the head of MAMMALIA, and those of the fishes above-mentioned under FISHES, and shall, therefore, conclude this part of our subject by a brief reference to the figures on plates 34 and 35.

Pl. 35, *fig.* 1, represents a party of fishermen in the act of capturing tunnies, according to the method practised in the Mediterranean. The entire apparatus is shown in *pl.* 34, *fig.* 9, consisting of huge nets, arranged in a succession of chambers, in one of which the scene first mentioned is supposed to be taking place. *Pl.* 35, *fig.* 2, shows a scene of the whale-fishery; a party of men about to harpoon a whale, with the ships in the distance, from one of which is streaming the smoke evolved in trying out the blubber. The dead whales, previously captured, form part of the picture. In *pl.* 35, *fig.* 3, we see fishermen catching herrings by means of an enormous net. The number thus taken amounts sometimes to 120,000 or 140,000 at a single haul.

Pl. 34, *figs.* 13 and 14, present incidents in cod-fishing. Oysters are taken by means of the *rakes* (*pl.* 34, *fig.* 11), and sometimes by a kind of *dredge* (*fig.* 12). Crabs and lobsters are caught in *pots* (*fig.* 10) baited with meat.

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